In the United States Court of Federal Claims

No. 03-2621C
(Filed: February 10, 2016)[1]

SYSTEM FUELS, INC., ENTERGY LOUISIANA, INC., and ENTERGY LOUISIANA, LLC,	*	**Spent Nuclear Fuel; Partial Breach of Contract; Damages; Causation; Reracking Costs; Cask Loading Costs; Crane Upgrade Costs; Fuel Handling Building Modification Costs; General Project Management Costs; NRC Fees; Allegedly Unsupported Transactions.**
Plaintiffs,	*	
v.	*	
THE UNITED STATES,	*	
Defendant.	*	

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[1] The Court issued this opinion under seal on January 31, 2016, and ordered the parties to file proposed redactions by February 12, 2016. The Court publishes this Opinion indicating redactions and correcting errata. Redactions are indicated by asterisks "[***]."

OPINION AND ORDER ENTERING JUDGMENT

WILLIAMS, Judge.

This spent nuclear fuel[2] case comes before the Court following a trial on damages. Because the Government's liability for partial breach of contract has been established, the only issue before this Court is the quantum of damages owed to Plaintiffs. Plaintiffs System Fuels, Inc., Entergy Louisiana, Inc., and Entergy Louisiana LLC (collectively, "Plaintiffs") seek $80,795,000 in damages incurred over a 16-year period from January 1, 1996, through June 30, 2012, stemming from the Department of Energy's ("DOE") partial breach of the 1983 Standard Contract for Disposal of Spent Nuclear Fuel and/or High Level Radioactive Waste ("Standard Contract"). The Government challenges $33,688,589 of Plaintiffs' claim. Based on the record developed at trial, the Court awards Plaintiffs $49,403,339 in damages.[3]

[2] Congress defined spent nuclear fuel as fuel that "'has been withdrawn from a nuclear reactor following irradiation, the constituent elements of which have not been separated by reprocessing.'" See Sys. Fuels, Inc. v. United States, 120 Fed. Cl. 635, 642 n.2 (2015) (quoting 42 U.S.C. § 10101(23)). "SNF contains toxic uranium and toxic byproducts, such as plutonium, and 'remains radioactive after it is removed from a nuclear reactor and must be isolated in safe disposal facilities for thousands of years.'" Id. (quoting Sacramento Mun. Util. Dist. v. United States, 63 Fed. Cl. 495, 496 (2005)).

[3] Like many spent nuclear fuel ("SNF") cases, this case was stayed pending appellate consideration of governing legal issues. The stay was in effect from January 19, 2007 until January 19, 2010, when it was temporarily lifted to allow Plaintiffs to file an amended complaint. The stay was continued from March 16, 2010 until November 1, 2011.

This Court held a trial on damages from November 3, 2014 to November 7, 2014, and November 17, 2014 to November 25, 2014. The Court conducted a site visit of the Waterford Steam Electric Generating Station, Unit 3 ("Waterford 3") in Killona, Louisiana on October 29, 2014. After briefing was completed, the Court granted Defendant's motion to strike the testimony of Plaintiffs' expert regarding "Waterford's reliance upon or consideration of ANO's [Arkansas Nuclear One's] allocation rights and spent fuel storage capacity in the non-breach world." Order 1 (Oct. 6, 2015) (internal citation and quotation marks omitted). The Court held that the testimony at trial regarding the use of these allocations was a new, undisclosed expert opinion. Id. at 9.

Findings of Fact[4]

The Nuclear Waste Policy Act and the Standard Contract

In 1982, Congress enacted the Nuclear Waste Policy Act ("NWPA" or "the Act") in response to safety and environmental concerns about the accumulation of radioactive waste. 42 U.S.C. §§ 10101-270 (2012). The Act authorized the Secretary of Energy "to enter into contracts with any person who generates or holds title to high-level radioactive waste, or spent nuclear fuel [SNF] of domestic origin for the acceptance of title, subsequent transportation, and disposal of such waste or spent fuel." Id. at § 10222(a)(1), held unconstitutional on other grounds by Ala. Power Co. v. U.S. Dep't of Energy, 307 F.3d 1300 (11th Cir. 2002). Pursuant to section 302 of the NWPA, utilities would enter into a Standard Contract with the United States Government acting through DOE. In return for fees assessed against the utilities contracting with DOE for disposal of spent nuclear fuel, Congress imposed on DOE the unconditional obligation to take title to, transport, and dispose of the spent nuclear fuel generated by these utilities no later than January 31, 1998. Id. at § 10222(a)(5)(B); JX 1, Art. II. The Act prohibited the Nuclear Regulatory Commission ("NRC") from issuing or renewing licenses to utilities that had not "entered into a [Standard Contract] with the Secretary" or who were not "actively and in good faith negotiating with the Secretary for a contract," effectively making such contracts mandatory for the industry. Me. Yankee Atomic Power Co. v. United States, 225 F.3d 1336, 1337 (Fed. Cir. 2000). As a result, the entire nuclear electric industry entered into individual contracts with the Government for the disposal of spent nuclear fuel. See NWPA, Section § 10222(b)(1)(A)(i)-(ii); see also Maine Yankee, 225 F.3d at 1337.

Pursuant to the Standard Contract, DOE is responsible for taking title to the utilities' spent nuclear fuel and transporting the spent nuclear fuel to its facility, and each utility is responsible for preparing and loading the spent nuclear fuel for transportation. JX 1, Art. IV. A.2, B.1-2.; see also Energy Nw. v. United States, 641 F.3d 1300, 1302-03 (Fed. Cir. 2011) ("Energy Northwest III"). The Standard Contract provides:

> The Purchaser [the utility] shall arrange for, and provide, all preparation, packaging, required inspections, and loading activities necessary for the transportation of [spent nuclear fuel] and/or [high-level waste] to the DOE facility.

JX 1, Art. IV.A.2.

The Standard Contract did not set forth the rates at which, or the order in which, DOE would accept spent nuclear fuel from nuclear facilities. Instead, the contract required DOE to issue annual capacity reports ("ACRs") to establish how much fuel DOE was obligated to accept each year, and annual priority rankings to establish the order in which DOE would allocate the projected capacity across the nuclear facilities. Id. at Art IV. B.5(b). Pursuant to the Standard

[4] These findings of fact are derived from the evidence adduced at trial and stipulations. The Court uses "PX," "DX," and "JX" to designate exhibits admitted during trial and "Tr." to cite trial testimony. The cited exhibit page numbers are the last four digits of the Bates number assigned to a given page or to the document's internal page numbers or section numbers as appropriate. Demonstrative exhibits are cited herein as "PDX" and "DDX."

Contract, DOE issued its first report on the acceptance rate in June 1987, and subsequent reports in June 1988, December 1990, and December 1991. The Federal Circuit later designated the 1987 Annual Capacity Report as the official report on the SNF acceptance rates for calculating rate commitments and damages because it more accurately depicted the parties' intent for complete contract performance. See Yankee Atomic Elec. Co. v. United States, 536 F.3d 1268, 1274 (Fed. Cir. 2008). The 1987 Annual Capacity Report included DOE's spent nuclear fuel acceptance rates for the first 10 years of DOE's SNF acceptance – from 1998 through 2007. Additionally, as stated in the Standard Contract, the spent nuclear fuel acceptance priority among contract holders was on an "oldest fuel first" basis – determined by the date of permanent fuel discharge from a licensee's nuclear power plant. JX 1, Art. VI. B.1(a).

Under the Standard Contract, each Purchaser was required to submit a delivery commitment schedule identifying the spent nuclear fuel it wanted to deliver to DOE 63 months in advance of the delivery year. Id. at Art. V. DOE could approve or disapprove this schedule within three months of receipt. Id. Additionally, Purchasers were required to submit final delivery schedules at least one year before the delivery date, and DOE would approve or disapprove these final schedules within 45 days of receipt. Id. Purchasers had the right to adjust the quantities of spent nuclear fuel that DOE would receive by plus or minus 20% until the submission of the final delivery schedule. Id.

The Standard Contract gave Purchasers the right to exchange approved delivery commitment schedules with "parties to other contracts with DOE," although DOE reserved the right to approve or disapprove these exchanges. Id. The exchange provision stated that Purchasers "shall have the right to determine" which fuel would be delivered to DOE. Id. In order to exchange DOE delivery dates, a Purchaser had to submit an exchange request to DOE not less than six months prior to the delivery date set out in the Purchaser's delivery commitment schedule. Id.

On February 2, 1984, Plaintiffs entered into a Standard Contract with DOE to collect and dispose of spent nuclear fuel retained at Waterford 3. Second Am. Compl. ¶ 9; see JX 1. The Purchaser listed in the Standard Contract was System Fuels, Inc. ("SFI"). According to Plaintiffs, Waterford 3 is owned by Entergy Louisiana, but SFI "performs all duties of the Purchaser under the Standard Contract on behalf of Entergy Louisiana, including payment of the quarterly fee." Second Am. Compl. ¶ 2, n.3. The NRC issued an operating license to Waterford 3 in 1984. Id. ¶ 2.

DOE's Partial Breach of the Standard Contract

In 1987, Congress amended the NWPA to require DOE to develop only one permanent geologic repository for nuclear waste – Yucca Mountain in Nevada – and to forbid DOE from constructing an interim storage facility until the NRC authorized the permanent facility. Nuclear Waste Policy Amendments Act of 1987, Pub. L. No. 100-203, §§ 5001-65, 101 Stat. 1330, 1330-227 (codified at NWPA, 42 U.S.C. § 10172(a)-(b)). On February 17, 1993, DOE issued a statement asserting that it did not have a legal obligation to accept spent nuclear fuel prior to the operation of a permanent fuel repository. JX 30 at 0317. At this point, the utilities estimated that DOE would not have a functioning repository until 2010. Id. On April 28, 1995, DOE issued its "Final Interpretation" of its obligation under the Standard Contract, and acknowledged that it would not begin accepting spent nuclear fuel by the January 31, 1998 deadline, but posited

that it did not have an unconditional obligation to commence performance on that date. Office of Civilian Radioactive Waste Mgmt; Nuclear Waste Acceptance Issues, 60 Fed.Reg. 21,793, 21,794-95 (May 3, 1995). Under the judicial review provision of the NWPA, the utilities challenged this Final Interpretation in the United States Court of Appeals for the District of Columbia ("D.C. Circuit"). Ind. Mich. Power Co. v. Dep't of Energy, 88 F.3d 1272, 1274 (D.C. Cir. 1996). Finding that the NWPA created an unconditional obligation for DOE to commence acceptance of spent nuclear fuel by 1998, the D.C. Circuit vacated and remanded DOE's Final Interpretation. Id. at 1277.

Nevertheless, DOE notified utilities that it would not timely accept spent nuclear fuel because it was bereft of a permanent or temporary repository. DOE asserted that under Article IX of the Standard Contract, the "unavoidable delays" clause, its delay in collecting the SNF was not compensable. Utilities subsequently petitioned the D.C. Circuit for review and a writ of mandamus to compel the DOE to fulfill its statutory obligation. In Northern States Power Co. v. United States Department of Energy ("Northern States I"), the D.C. Circuit reaffirmed that DOE had an unconditional obligation to accept spent nuclear fuel by 1998, and issued a limited writ of mandamus "precluding DOE from advancing any construction of the Standard Contract that would excuse its delinquency on the ground that it has not yet established a permanent repository or an interim storage program." 128 F.3d 754, 756 (D.C. Cir. 1997). This order did not require specific performance or impose any contractual remedies, which remained within the purview of the United States Court of Federal Claims. Neb. Pub. Power Dist. v. United States, 590 F.3d 1357, 1376 (Fed. Cir. 2010) (en banc) ("NPPD"). The Federal Circuit later afforded this ruling res judicata effect on the issue of liability. Id. at 1363-65, 1376.

On August 31, 2000, the Federal Circuit held that the Government breached every Standard Contract upon failure to commence the collection of spent nuclear fuel on January 31, 1998. Maine Yankee, 225 F.3d at 1342-43. This failure to begin collecting spent nuclear fuel in 1998 constitutes a partial breach of the Standard Contract. Yankee Atomic, 536 F.3d at 1280.

Nevertheless, the Government has continued to push back the date it would collect and dispose of spent nuclear fuel, and in the Fiscal Year 2010 federal budget, announced that the program to construct a federal repository for spent nuclear fuel disposal at Yucca Mountain was terminated. See Office of Management and Budget, Terminations, Reductions, and Savings, Budget of the U.S. Gov't Fiscal Year 2010, 68, www.gpo.fdsys/pkg/BUDGET-2010-TRS/pdf/BUDGET-2010-TRS.pdf (last visited Sept. 10, 2015). The Government plans to accept SNF into a repository in 2048. Tr. 99.

The Government continued to collect the fees required by the Standard Contract from the utilities until November 19, 2013, when the D.C. Circuit ordered the Secretary of Energy to submit a proposal to Congress to change the fee to zero. See Nat'l Ass'n of Regulatory Util. Comm'rs v. U.S. Dep't of Energy, 736 F.3d 517, 521 (D.C. Cir. 2013). Plaintiffs allege that they paid approximately $217.3 million into the Nuclear Waste Fund as of June 30, 2012. Second Am. Compl. ¶ 9.

Categories of Challenged Damages

Defendants assert that Plaintiffs' claimed damages of $80,795,000 should be reduced by deducting the following allegedly unrecoverable costs:

1) $8,490,310 for the reracking performed at Waterford 3
2) $8,505,653 for modifications to the fuel handling building's cask handling crane
3) $7,240,114 in other fuel handling building and plant modifications
4) $1,789,227 in general project management
5) $3,966,282 in cask loading costs
6) $266,276 in payroll loader costs for Resource Codes 19 and 60
7) $1,942,000 in Nuclear Regulatory Commission ("NRC") Part 171 fees
8) $1,488,727 in unsupported transactions.

Waterford 3 Fuel Cycle

The NRC issued an operating license to Waterford 3 on December 18, 1984. PX 1036 at 2546. Waterford 3 is a pressurized water reactor that uses uranium dioxide fuel. Tr. 841. The uranium dioxide is in the form of pellets, which are loaded into 14-foot long fuel rods by the fuel supplier. Id. at 55. These rods join together into fuel assemblies, which are placed into the plant's reactor core. Id. Waterford 3 uses approximately 217 assemblies. Id. Thus, 217 spaces are needed to remove all of the fuel from the reactor. Id. at 939. At each refueling, which takes place generally every 18 months at Waterford 3, one third to one half of the assemblies are replaced. Id. at 52-53. During a refueling outage, the plant ceases to operate, giving reactor personnel the opportunity to perform maintenance. Id. at 310. The time in between each refueling is referred to as a cycle. Id. at 743. Entergy attempts to perform refueling outages in the fall or spring, when electricity demand is not high. Id. at 2529-30. When the old fuel comes out of the reactor, it must be stored underwater in the plant's spent fuel pool because it contains highly radioactive fission products. Id. at 56.

Plaintiffs' Operating Philosophy

According to testimony of its employees, Plaintiffs' plant operating philosophies placed an emphasis on advance planning. Mr. Clint Alday, a supervisor and reactor engineer,[5] testified that Waterford 3 coordinated its "system planning" with Entergy headquarters in Jackson, Mississippi, leading to a practice of evaluating spent fuel storage five years in advance. Id. at 1034.

[5] Mr. Clint Alday is employed by Entergy Operations, Inc. and, at the time of trial, was "on loan to the Institute of Nuclear Power Operations" to serve as a senior evaluator. Tr. 835. After working as a nuclear engineer at other plants, he became a reactor engineer at Waterford 3 in 1990. Id. at 843. Mr. Alday eventually became the superintendent of reactor nuclear systems engineering in 1998, the supervisor of reactor engineering and the special nuclear material custodian in 1999, and the system engineering manager in 2009, and then was again the supervisor of reactor engineering in 2011. Id. at 847-51. Mr. Alday served as the Plaintiffs' corporate representative during trial. Id. at 6-7.

A key concept used in making fuel storage decisions at Waterford 3 was maintaining full core reserve or full core discharge capability. This "important planning concept" meant maintaining enough space in the spent fuel pool to discharge all the fuel assemblies from the reactor core – 217 assemblies at Waterford 3. Id. at 100. The purpose of maintaining full core reserve was to ensure that all of the fuel could be removed from the reactor to allow for inspection or maintenance. Id. at 101. Waterford 3 attempted to have full core reserve "at all times." Id. at 100. Waterford 3 occasionally infringed on full core reserve, but the plant would "work hard" to avoid this state. Id. 101-02, 194. Maintaining full core reserve was not a regulatory or an operating requirement, but "a target" and an example of "prudent planning" because there might be times when the reactor had to be completely emptied of fuel. Id. at 102-03. Without being able to perform unscheduled repairs or inspections, the plant could not be restarted, which would cause between $500,000 to $1 million a day in replacement power costs. Id. at 103-04. Additionally, if there were no room in the spent fuel pool to unload old fuel from the reactor, the reactor could not be refueled and would be unable to operate. Id. at 105-06.

Because they were running a "multi-billion-dollar asset" that generates hundreds of thousands of dollars per day, Waterford 3 personnel strove to make economically efficient decisions. See id. at 105-06. As a fleet, the Entergy plants sought to arrange the most economic fuel services at the least cost, including the "front-end" purchase of fuel and the "back-end" of storage. Id. at 95-96; JX 3 at 9047-48. At each of its sites, the company desired to do what was most efficient economically and to meet regulatory requirements. Tr. 150.

Safety was also extremely important at Waterford 3. As a nuclear power plant, Waterford 3 had to comply with a variety of NRC safety regulations. Id. at 762. Waterford 3's NRC license required compliance with mandatory technical specifications, that were part of Waterford 3's Final Safety Analysis Report ("FSAR"), which delineated the parameters of operations. Id. at 185-86, 1637. As the Court observed during its site visit, Waterford 3 personnel had a safety-conscious corporate culture and strove to avoid potential safety hazards, including exposure to radiation. As stated by Mr. Laque, "one of the principles for working in nuclear power is to try to keep the dose that each individual receives as low as possible."[6] Id. at 329. This principle is called "ALARA," or "as low as reasonably achievable." Id. at 329, 1655. When dealing with potential radiological contamination, Entergy's practice was to assume there was contamination unless proven otherwise. Id. at 362-63. This practice was part of Waterford 3's general "conservative decision-making." Id. at 363.

Spent Fuel Pool Rerack

On February 26, 1993, some 13 years before DOE was scheduled to pick up SNF from Waterford 3, Mr. Frank Rives authored a revised "Strategic and Tactical Plans for Nuclear Fuel

[6] Mr. Jason Laque is currently employed by Sid Munshi, Inc. as a contract senior engineer at Waterford 3. Id. at 178. Prior to February 2014, he was employed by Entergy Operations working as senior project manager for dry fuel storage at Waterford 3. Id. Mr. Laque has worked in several different capacities at Waterford 3 and other Entergy plants since 1986. Prior to becoming senior project manager, he worked as a maintenance manager. Id. at 179-81.

Management."[7] JX 3 at 9403. The purpose of the Strategic Plan was "to provide guidelines for nuclear fuel management for the System which will assist in minimizing the cost of operation of the Entergy System."[8] Id. at 9048. In addition to plans regarding the purchasing of fuel, one of the components of the Strategic Plan was the "provision for back end fuel cycle services with a sufficient lead time to prevent loss of discharge capability . . . at any of the System's reactors." Id. Mr. Alday testified that it was "a good practice" to "have plenty of planning time" when planning to implement a fuel storage project, such as the rerack. Tr. 1031.

In discussing spent fuel services at Entergy's fleet of utilities, Mr. Rives explained how critical it was to remove spent nuclear fuel, but that at the time, availability of pick up services was "highly uncertain," and the "DOE program and the status of the System's nuclear units [would] have to be monitored . . . ." JX 3 at 9055. He continued:

> Assurance of supply of spent fuel services is an important consideration. Failure to provide at least one of these services when needed would prevent a reactor from discharging spent fuel, and thereby prevent refueling and further operation. The System should arrange for the most economic service, or mix of services, in a timely manner so that spent fuel services are provided at the least cost. Onsite storage should be maximized to the extent that it is physically, economically, and legally practical. Each of the System's nuclear units will lose full-core discharge capability between the mid-1990s and the mid-2000s. About five years prior to the time that this capability is lost at each nuclear site, an evaluation should be performed to implement one of the available options. Such a process has been initiated for ANO-1 and 2. (Dry cask storage has been selected.) The status of storage options should be monitored to ensure that as many feasible alternatives as possible may be considered for application in the System.

Id.

In the Tactical Plan, Mr. Rives discussed the situation at the Arkansas Nuclear One ("ANO") plant, the Entergy plant that was going to lose full core reserve first, in 1995, and that decided to implement on-site dry storage. Id. at 9072, 9089. The Tactical Plan included charts indicating when each Entergy plant would lose full core reserve. The chart indicated that Waterford 3 would lose full core reserve in 2000, at the end of fuel cycle 10. Id. at 9092. Another chart showed that Waterford 3 would begin fuel cycle 10 on October 9, 1998, and that fuel cycle 10 would last 548 days, i.e. until April 9, 2000. Id. at 9075.

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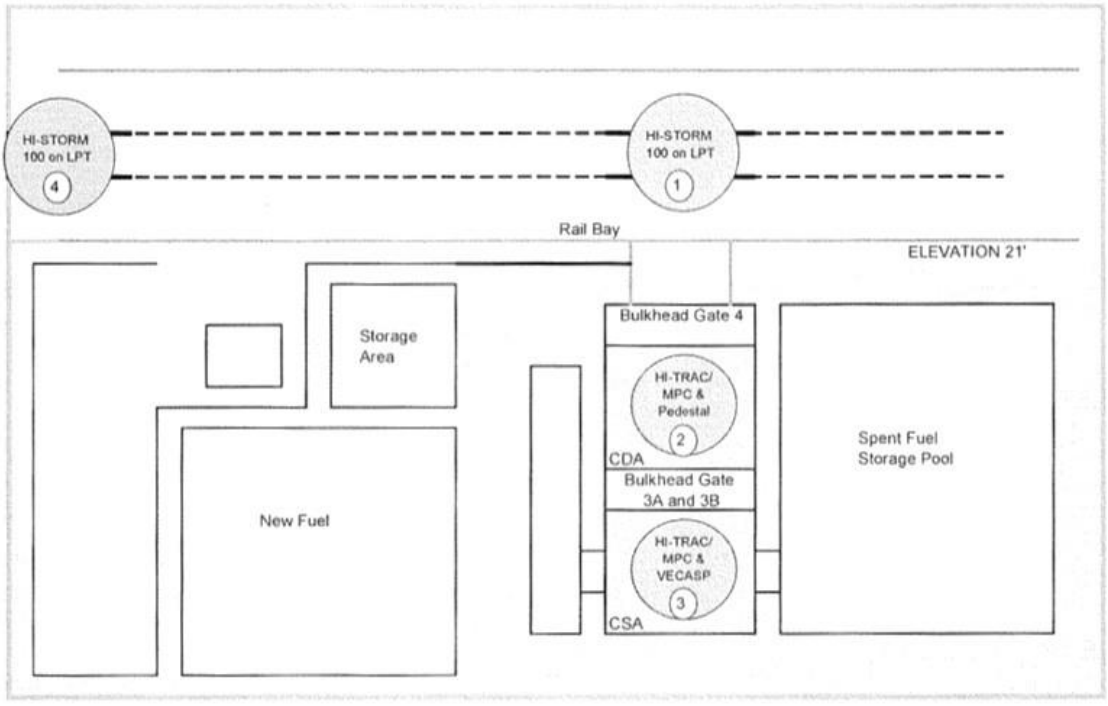
[7] Mr. Frank Rives is employed by Entergy Services, Inc. as the Director of Nuclear Fuels and has worked in this position since 1987. Id. at 51, 60. Mr. Rives is the contract manager for Entergy's contracts with DOE. Id. at 52.

[8] The Strategic Plan's guidelines were designed to have a five-year time horizon, while the Tactical Plan provided detail for the first two years of the Strategic Plan. JX 3 at 9049. The Strategic Plan and the Tactical Plan were generally updated annually and semi-annually, respectively. Id. at 9043.

Mr. Richard Finch testified that Waterford 3 began evaluating spent fuel storage options in 1994.[9] Tr. 2518-19. In 1994, Mr. Rives sent an email to another Entergy staff member about starting to "kick off the Waterford 3 spent fuel project." Id. at 159-60; DX 21 at 7869. Mr. Rives' handwritten notes on this email indicated that after he sent the email, he received a call from the recipient about forming a team at Waterford 3 to begin the spent fuel project, with an objective of providing additional storage by January 1999. DX 21 at 7869.

Waterford 3 made a decision to rerack the spent fuel pool to add capacity in 1996. The spent fuel pool is located in the fuel handling building. The spent fuel pool originally contained 16 Wachter Associates brand storage racks, which contained 1,088 fuel assembly storage spaces. Tr. 471; PX 1036 at 2544. Inside the fuel handling building, to the west of the spent fuel pool, is the cask storage area, which is separated from the spent fuel pool by Gate 1. PX 1023 at 2544. As seen in the following diagram, to the west of the cask storage area is the refueling canal. Gate 2 separates the cask storage area and the refueling canal. To the north of the cask storage area is the cask decontamination area. Gates 3A and 3B, located parallel to each other, separate the cask storage area from the cask decontamination area. Gate 4 separates the cask decontamination area from the fuel handling building's train bay. Id. at 2545; PX 1 at 14.



PX 1 at 14.

In January 1996, Mr. Finch authored a revised position paper on spent fuel storage. JX 6 at 7843. After noting that Waterford 3 would lose full core reserve in 2000 and represented "the next Entergy decision regarding additional storage," he stated that "Waterford-3's decision-

[9] Mr. Richard Finch has been retired since 2004, and began working for Entergy companies in 1974. Tr. 2474-76. Mr. Finch was a senior staff engineer in the engineering design department at the time of his retirement, a job he had held since 1990. Id. at 2476-77.

making process to provide that capacity has been initiated." Id. at 7844. Mr. Finch continued that the Design Engineering staff had prepared a "scoping review" of options for increasing Waterford 3's storage capacity, including shipping the spent fuel to DOE, dry fuel storage at another Entergy plant, dry fuel storage at an Indian reservation, on-site dry fuel storage, and rereacking. Id. The evaluation also considered "a review of the ANO project," an unsolicited proposal from the company that worked on dry storage at ANO to provide additional dry storage at other Entergy sites, and an unofficial estimate from reracking vendors. Id. The "only feasible options" were determined to be on-site dry storage and reracking. Id.

Mr. Finch concluded that it appeared that it might be appropriate for Waterford 3 to only take bids on reracking. Id. at 7845. Mr. Finch noted specific benefits of reracking, namely the provision of an additional 18 years of storage capacity at a lower cost than dry storage, a shorter project scope, less exposure to delays, and the removal of "the existing boroflex neutron absorber (boroflex degredation is a potential concern)." Id.[10] Furthermore, reracking increased the chances that there could be an off-site storage or disposal facility in operation by the time additional action was needed, such that reracking would be the only capacity addition required by the plant. Id. Mr. Finch also stated that Waterford 3's situation was different from that of the ANO plants, which had chosen on-site dry storage, as reracking at ANO would have only provided a much shorter extension of the date that additional capacity was required. Id. Additionally, Waterford 3's geography, soil conditions, and flooding potential made dry storage less attractive. Id. at 7846. Mr. Finch concluded by stating that the present plan was for Waterford 3 to obtain reracking bids "in the second quarter of 1996." Id.

On September 16, 1996, Mr. Finch prepared the Technical Evaluation Report on reracking proposals the company had received in response to a May 1996 request for bids. JX 30 at 0315, 0321. This document reviewed the options discussed in the January 1996 position paper, confirmed that Waterford decided to first pursue the reracking option, and listed the "favorable considerations associated" with reracking as:

1. The expense is estimated at approximately $12,000 per stored fuel assembly.

2. The existing Boroflex could be replaced to preclude any future problems.

3. It is a much smaller scope project than the on site dry spent fuel storage project. A reracking can be accomplished in approximately two years. It is also not a very visible project. It should not raise any political concerns.

4. The technology associated with reracking is mature.

5. An increase of 800-1000 storage spaces would provide Waterford 3 with spent fuel storage capacity until approximately the year 2018. This would give DOE time to place a spent fuel repository into operation.

[10] Boroflex was a boron carbide material that was used as a neutron poison to keep neutrons from being absorbed by the spent fuel and thus to prevent criticality in the spent fuel pool. Id. at 890, 1044. The boron carbide was part of a rubber compound that was in removable inserts between cells in the spent fuel pool. Id. at 892.

Id. at 0320-21. The "unfavorable considerations associated with reracking" were that a license amendment was required, the fuel handling building load bearing capacity would have to be reanalyzed, the spent fuel pool cooling system would have to be reanalyzed, and all of the spent fuel in the pool would have to be reshuffled to allow the existing racks to be removed. Id. at 0321. The proposal evaluation team recommended that Holtec International ("Holtec") be awarded the reracking contract. Id. at 0324.

The reracking contract was signed in October 1996. Tr. 2518. In order for Holtec to complete the reracking project, it was necessary for Waterford 3 to amend its NRC license. JX 30 at 0321. On March 27, 1997, Entergy submitted a proposed amendment in its technical specifications to the NRC and requested that the amendment be issued "no later than January 8, 1998." JX 8 at 1. This approval date was necessary to support both a rerack completion date of July 1998, when cycle 10 fuel would be arriving on site, and to support "the expeditious removal of the existing Boroflex racks." Id. Mr. Finch explained that cycle 10 fuel would have arrived at the plant 2-3 months before the next refueling outage to give the plant the opportunity to make sure nothing was wrong with the fuel before taking the plant offline to complete the refueling process. Tr. 2541.

The rerack was planned to begin at the end of fuel cycle 9, in October 1998. Id. at 2528. On July 10, 1998, the NRC approved Waterford 3's license amendment. Id. at 2536. On July 23, 1998, Entergy's configuration management group approved a design change package to allow changes to be made at the Waterford 3 plant. Id. at 459; PX 1036 at 2540. The July 1998 design change package stated that the rerack needed to occur during cycle 9 prior to the receipt of new fuel because after cycle 9 there would be too many assemblies in the spent fuel pool to allow the reracking to be completed using divers and maintain safe heavy load paths. PX 1036 at 2553-54. Mr. Frederick Smith[11] testified that the end of fuel cycle 9 was November 1998. Tr. 2228. Referring to his 1996 Technical Evaluation Report, which contained a table showing the historical and projected end dates of each fuel cycle, Mr. Finch testified that fuel cycle 9 was projected to end on October 15, 1998.[12] Id. at 2528-29; JX 30 at 0318. The authors of this document noted that loss of full core discharge capability would occur at Waterford 3 at the end of fuel cycle 10 in 2000. PX 1036 at 2546. While two additional fuel cycles could occur without full core discharge capability, the plant would have had to shut down in 2004, if no additional storage was added. Id.; Tr. 465.

The installation of new Holtec racks was completed in November 1998. Tr. 2518. This work involved removing the old Wachter Associates racks and adding new racks to the spent fuel pool and the cask storage area. The racks were put in the cask storage area. PX 1036 at

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[11] Mr. Frederick Smith is the senior manager of fuel for Entergy Services, and has responsibility "for all of the fuel for the Southern fleet." Id. at 2145. Mr. Smith joined Entergy in 1982, in the corporate Nuclear Analysis Department and became manager of Entergy's fuel program in 2008. Id. at 2144-45. Mr. Smith took on his current role in November 2013. Id. at 2145.

[12] Due to the rerack work, fuel cycle 9 actually ended in 1999. Id. at 2528-29. Specifically, because new works were still being installed in the spent fuel pool, the plant was "not in the outage at that time." Id. at 2528.

2549. Preparing the cask storage area to receive racks involved sealing a drain in the cask storage area, cutting gussets off Gate 3A, and installing platforms in the bottom of the cask storage area. Id.; Tr. 471-73. Additional work involved modifying the spent fuel pool spargers, piping, underwater lighting, and return lines so that they did not interfere with the new racks, and moving a limit switch on the fuel handling building crane. PX 1036 at 2549-50; Tr. 473-75. Finally, Waterford 3's Spent Fuel Handling Machine had to be reprogrammed to access all of the new spaces, and it was planned that Holtec would supply a new Offset Handling Tool to access spaces that were inaccessible with the current tool. PX 1036 at 2550; Tr. 2494.

Holtec's reracking contract guaranteed to increase storage capacity to 2,104 usable spaces. Tr. 2500. This consisted of 1,849 spaces in the spent fuel pool and 255 in the cask storage area. PX 1036 at 2548. Waterford 3 was also licensed to place racks in the refueling canal, but these would not be used until the plant permanently shut down. JX 8 at 5. Because of reserved cells, restricted cells, and inaccessible cells, only 1,659 spaces were available in the spent fuel pool as of October 2004. PX 810 at 6812. Furthermore, the cask storage area racks had certain limitations as to use, leaving only 140 spaces available in that area to temporarily store spent fuel. Id. at 6813.

The new Offset Handling Tool proved to be unacceptable, as it apparently failed several usage tests. Tr. 2477-78. Eventually, in 2012, the Offset Handling Tool was completed and allowed access to all but 20 of the 209 previously inaccessible spaces. Id. at 931.

Boroflex Issues

The old Wachter Associates racks contained Boroflex, a neutron poison material. The new Holtec racks contained Boral. Boral is a neutron poison material that is fixed into the racks, as opposed to removable Boroflex inserts. Id. at 892. In the early 1990s, the nuclear industry made efforts to deal with Boroflex problems. Id. at 2150-51. When Boroflex is bombarded with gamma radiation from the spent fuel, the rubber molecules can disintegrate, causing shrinkage and tears. Id. Over time, this will cause the loss of neutron-absorbing material, which impacts the criticality analyses that nuclear plants perform on the spent fuel pool to ensure that the spent fuel does not start a critical reaction. Id. at 2151-52. Additionally, the Boroflex material can degrade and dissolve into the water of the spent fuel pool. Id. at 2154. When this dissolution occurs, silica is released into the spent fuel pool, and if silica is able to enter the reactor, it can potentially damage the reactor fuel. Id. at 2157.

At Waterford 3, the Boroflex was tested with a process called blackness testing. Id. at 852. Blackness testing was conducted by placing a neutron source in a selected cell and determining how many neutrons could pass through, which allowed analysis of gaps in the rubber compound. Id. at 853-54. A software program called RACKLIFE, which predicts neutrons absorbed or lost in the spent fuel pool, was used to ascertain how many panels are needed to test the condition of the Boroflex. Id. at 1052-53, 2167. BADGER testing is the current standard for Boroflex testing. Id. at 2160-61. BADGER testing is similar to blackness testing, but requires more resources to test a panel than blackness testing. Id. at 2164.

The NRC issued a generic letter in 1996, requesting a response about how to manage Boroflex degradation from plants using Boroflex. Id. at 1042. Waterford 3 responded in October 1996, describing how Boroflex monitoring had been occurring since 1992, and stating

that it would continue its surveillance program and would conduct a silica analysis of the spent fuel pool. PX 803 at 613-14, 617.

On October 23, 1997, Waterford 3 completed its silica analysis, which showed that the racks had "high silica loss and a correspondingly high [boron carbide] loss." DX 39 at 0796. Waterford 3's October 1996 response to the NRC's generic letter noted:

> Waterford 3 has evaluated options to replace the existing spent fuel pool storage racks in order to increase the number of storage locations. The replacement is currently planned to occur during the Summer of 1998. The replacement racks will use Boral, instead of Boraflex, as the neutron absorber.

PX 803 at 6714. Further, the response stated that monitoring would continue until the Waterford 3 racks were replaced. Id. at 6717. Mr. Alday testified that the Waterford 3 spent fuel pool never had high enough silica levels to cause concern about it impacting the reactor and that the pool's normal filtration system removed any silica from the degraded Boroflex. Tr. 898-99. As Boroflex degrades, it releases silica into the spent fuel pool. Id. at 898. However, Mr. Alday testified that Waterford's spent fuel pool filtration removed any silica from the water in the spent fuel pool. Id. Mr. Alday explained that the system "pump[ed] the water through filters and ion exchanges to clean the impurities out of the water," and that this system was so effective at trapping any silica that may have escaped from the degraded Boroflex, that to his knowledge, Waterford "never took any additional actions other than the normal cleanup system." Id. at 899.

Boroflex is still used at several Entergy plants. The NRC requires plants that still use Boroflex to maintain a monitoring program. Id. at 2165. Continuing to use Boroflex may require the plant to take mitigation measures such as checkerboarding, or locating two fuel assemblies diagonally in the pool instead of side by side, which results in a loss of useable cells. Id. at 1052, 2156, 2211. Although no checkerboarding has occurred at the Pilgrim plant, checkerboarding is currently used at Grand Gulf. Id. at 2156. Furthermore, continued degradation of Boroflex could result in a plant needing to perform a silica cleanup campaign. Id. at 1052. Other mitigation strategies for dealing with Boroflex degradation are avoiding placing recently discharged fuel into cells that have been subjected to high levels of radiation exposure and creating separate pool regions. Id. at 2274-75. Both of these methods increase the complexity of controlling the spent fuel pool. Id.

The removal of Boroflex was listed as a benefit of reracking in contemporaneous Waterford 3 documents, including in Mr. Finch's January 1996 position paper. JX 6 at 7845. Mr. Finch's September 1996 Technical Evaluation Report outlining reracking proposals also mentioned this advantage. JX 30 at 0320.

The Court finds that removing the degraded Boroflex was not the primary reason for conducting the rerack, but was an additional incentive to reracking beyond gaining more storage space. Reracking allowed Waterford 3 to avoid monitoring Boroflex beyond 1998, and also to avoid eventually taking measures, such as checkerboarding, that would have further reduced the amount of space in the spent fuel pool.

Plaintiffs' Claimed Reracking Damages and Model of Non-Breach World

In the breach world, Waterford 3 reracked in November 1998. The rerack permitted Entergy to keep storing fuel in the pool until 2011. The parties agree that in the non-breach world, Waterford 3 would not have had DOE acceptance rights under the Standard Contract until 2006. Tr. 1733-34, 2399-2400. The parties do not dispute that Plaintiffs would have lost full core reserve in 2000 - - six years before DOE was scheduled to pick up SNF - - had they not done the rerack project. However, Plaintiffs claim damages of $9,814,067 for the rerack project, asserting that this project would not have been necessary in the non-breach world.[13] Plaintiffs' economic damages expert, Kenneth Metcalfe,[14] created a model, working with Entergy personnel and using the report of fuel discharges prepared by Ms. Eileen Supko,[15] Plaintiffs' expert in

[13] Prior to trial, the parties stipulated to the amounts claimed by Plaintiffs for the various elements of their damages claim. The amount stipulated for the rerack was $8,490,310, exclusive of the $1,253,893 the Government challenges as unsupported costs and the $69,864 the Government challenges as unrecoverable payroll loaders that are both associated with the rerack project. In addition to the $8,490,310 figure, Plaintiffs also confusingly use $10,563,000 as the amount they incurred in reracking costs due to DOE's breach. Compare Pls.' Post-Trial Br. 14 ("Plaintiffs' claim related to the purchase and installation of additional spent fuel storage racks totals approximately $10,563,000 through June 30, 2012.") with 37 ("The following chart identifies the issues, and the amounts associated therewith, that remain in dispute between the parties: 1. Spent Fuel Pool Re-rack: $8,490,310 . . . ."). This $10,563,000 amount was derived by Mr. Metcalfe and represents a total of $11,563,000 minus a $1 million Holtec credit for the non-functional offset fuel handling tool. Tr. 1784. The Court will use the stipulated figures in this opinion.

[14] Mr. Metcalfe was qualified as an expert in "economic damages, cost, and regulatory accounting in the public utility industry." Id. at 1702. Mr. Metcalfe is the President and co-founder of the Kenrich Group, which was formed in 2004. Id. at 1676-77. Mr. Metcalfe has a bachelor of science in business administration from Georgetown University, is a certified public accountant in Virginia, a certified valuation analyst with the National Association of Certified Valuators and Analysts, and is an "associate certified fraud examiner." Id. at 1677. Mr. Metcalfe is a member of several professional organizations and has worked in business management and litigation consulting since 1982. Id. at 1679, 1682.

[15] Ms. Supko is currently employed as the president of Energy Resources International ("ERI"), a nuclear fuel cycle consulting company. Id. at 1453. She received a bachelor of science in nuclear engineering from Pennsylvania State University in 1985, and worked as a fuel projects engineer and in-core analysis engineer for the Carolina Power & Light Company. Id. at 1453-54. Ms. Supko began working for ERI in 1990 as a consultant. Id. at 1456.

Ms. Supko provides consulting services associated with nuclear fuel management, spent nuclear fuel management, radioactive materials and spent fuel transportation, and radioactive materials and spent fuel disposal. Id. Her clients "include nuclear power plant operating companies, a foreign government, industry organizations, private companies, and a private [spent nuclear fuel] management organization." PX 1 at 4. From 1990 to 2004, Ms. Supko "was a

nuclear waste management, storage, and transportation and associated plant modifications, to explain why Waterford 3 would not have reracked in 1998 had the Government subsequently started to accept spent nuclear fuel as required by the Standard Contract in 2006.

Mr. Metcalfe's fuel management model applied available acceptance rights of two other plants Entergy later acquired, Pilgrim and Indian Point 3. He applied all of Pilgrim's rights to Waterford 3 in the year 2000 and all of Indian Point 3's acceptance rights to Waterford 3 for the years 2001-05, using exchanges. PDX 7 at 14; PX 357; Tr. 1737, 1755-56. After the rerack occurred, Entergy acquired two new nuclear plants, the Pilgrim plant in July 1999 and the Indian Point 3 plant in November 2000. Joint Stip. ¶¶ 7-8. Pilgrim was the first nuclear plant to be sold through a competitive bidding process. Tr. 166. Mr. Rives testified that prior to closing on both new plants, there was a due diligence period that went on for several years and that Entergy was aware of the number of DOE spent fuel pickup allocations that each plant had prior to the official sale of the plant. Id. at 129-30. However, no testimony was provided on the exact parameters of this due diligence and when, definitively, Waterford 3 began to consider purchasing both plants. Mr. Rives was asked if it was correct that the Pilgrim plant was offered for sale in June 1998, but he did not know this date or the details of when work began on the purchase of the plant. Id. at 165.

In 1995-96, when Plaintiffs were anticipating running out of space in the spent fuel pool in 2000, they did not know that they would own these plants. The DOE acceptance allocations would not have been available for Entergy to use until the plants were officially purchased in 1999 and 2000. Id. at 167-68. In Mr. Metcalfe's non-breach world scenario, Plaintiffs would have used exchanges to obtain Pilgrim and Indian Point 3's acceptance rights, and DOE would have removed spent nuclear fuel from Waterford 3 in the years 2000-05, instead of from Pilgrim and Indian Point 3. Waterford 3 would have used its own acceptance rights from the year 2006 onward. PX 357. This model would allow Waterford 3 to maintain its full core reserve in all years, so that no additional mitigation activities, particularly reracking and dry storage, would have been necessary. Tr. 1742.[16]

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direct participant as an industry consultant in technical exchanges between the nuclear industry and DOE . . . ." Id. At the recommendation of DOE, Ms. Supko served as a U.S. technical expert to the International Atomic Energy Agency. Id. Since 2002, Ms. Supko has served as the "Principal North American Representative to the World Nuclear Transport Institute." Id. at 6. Ms. Supko has "authored more than 50 reports, presentations, and publications in leading nuclear energy journals and [has] been an invited speaker at over two dozen conferences sponsored by leaders in the nuclear industry." Id.

Ms. Supko was also qualified in regulatory requirements, including "modeling acceptance rate scenarios including [greater than class C] waste, allocation of acceptance rates including [greater than class C] waste, and the effects of the acceptance rate scenarios on the reactor storage spent fuel acceptance." Tr. 1509.

[16] On October 6, 2015, the Court granted Defendant's motion to strike Mr. Metcalfe's testimony regarding "Waterford's reliance upon or consideration of ANO's [Arkansas Nuclear One's] allocation rights and spent fuel storage capacity in the non-breach world." Order 1 (Oct.

Defendant's Expert Testimony on Plaintiffs' Model of Non-Breach World

Both Mr. Gregory Maret[17] and Dr. Jonathan Neuberger[18] asserted that Mr. Metcalfe's fuel management model was unreliable and unrealistic. Dr. Neuberger emphasized that while

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6, 2015) (internal citation and quotation marks omitted). The Court held that the testimony at trial regarding the use of these allocations was a new and undisclosed expert opinion and should be stricken from the record. Id. at 9. Given the Court's order, there is no probative evidence that Plaintiffs were able to consider ANO's allocation rights as a stop-gap measure or a place holder for potential exchanges prior to the purchase of the Pilgrim and Indian Point 3 plants. Tr. 1756-57. This need for a stop-gap arose because in 1995-96, when Waterford 3 was evaluating its spent fuel storage options, it did not know that Entergy would later own Pilgrim and Indian Point 3. Id. at 1991. In the stricken testimony, Mr. Metcalfe posited that in 1995-96, in the non-breach world, Waterford 3 would have planned for additional spent fuel storage, but instead of deciding to rerack as occurred in the breach world, would have planned to use some of ANO's acceptance rights in 1999. Id. at 2110; PDX 7 at 25. The Court also struck the parts of Dr. Neuberger's testimony that discussed Mr. Metcalfe's ANO opinion. Dr. Neuberger, in his expert report, opined that Mr. Metcalfe's model was flawed because the allocations from Pilgrim and Indian Point 3 were not available in the mid-1990s when Waterford 3 was making its fuel storage decisions and hence could not have been used for planning purposes by Waterford 3. DX 187 at 17-18. Dr. Neuberger also noted that Mr. Metcalfe had not attempted to create a fleet-wide model of how allocations would be used across Entergy plants, and as a consequence, in other spent nuclear fuel litigation, inconsistently testified that the Pilgrim and Indian Point 3 allocations would be used differently than he has modeled in this case. Id. at 21-22.

[17] Mr. Gregory Maret was admitted as an expert in "nuclear power plant operations and management." Tr. 2616. At the time of trial, Mr. Maret was employed by Sequoia Consulting Group, although when he produced his expert report, in December 2012, he was "an independent consultant contracted with ABZ, Incorporated, an engineering consulting company performing work related to the commercial nuclear power industry." Id. at 2576; DX 177 at 2. Mr. Maret received a bachelor of science degree in nuclear engineering, a master of engineering in nuclear engineering, and a master of engineering in electric power engineering from Rensselaer Polytechnic Institute. Tr. 2576. After receiving his graduate degrees in 1981, Mr. Maret worked in the nuclear industry until 1999. Mr. Maret has "experience in design, construction, testing and operation of nuclear reactors and reactor systems." Id. at 2580-81, 2601; DX 177 at 2. Mr. Maret has provided consulting services "for international nuclear regulatory agencies and operators, as well as domestic utilities and suppliers." DX 177 at 2. Mr. Maret has provided expert reports and/or testimony in 10 other spent nuclear fuel cases. Id. at 3.

[18] Dr. Jonathan Neuberger was admitted as an expert in "economic modeling and the quantification of economic harm." Tr. 2358. Dr. Neuberger is a principal in the economic consulting firm Economists Incorporated and has a bachelor of science in international relations from Georgetown University, a master's degree in economics from Johns Hopkins University, and a Ph.D in economics from Johns Hopkins University. DX 187 at 2-3. Dr. Neuberger has worked as an economist for several different firms and as a Visiting Assistant Professor of Economics at Mills College, in Oakland, California. Id. at 3. Dr. Neuberger has provided expert

Mr. Metcalfe hypothesized that Waterford 3 could have used inter-utility exchanges or the Standard Contract's plus-or-minus 20% allocation, Mr. Metcalfe had not analyzed the plausibility or potential costs of these options, rendering their use purely speculative. DX 187 at 24-29. Dr. Neuberger believed that Mr. Metcalfe's model left out costs, as he did not think it plausible that Waterford 3 would not have incurred any costs for dealing with spent fuel storage in the non-breach world, such as "planning, analyses, engineering studies, negotiations over inter-utility exchanges, arrangements between affiliated entities to - - acquire or confirm the existence of additional capacity." Tr. 2404.

Mr. Maret also analyzed Mr. Metcalfe's spent fuel management model and concluded that Waterford 3 would have reracked in 1998 even with DOE performance. DX 177 at 8. Mr. Maret asserted that two to three years were required to implement the reracking. Id. at 11. Mr. Maret opined, based on the October 12, 2012 deposition testimony of Mr. Finch, that Waterford 3 would have lost sufficient space in the spent fuel pool to allow reracking "at the end of 1998." Id. Mr. Maret stated that Mr. Metcalfe's presumption that, instead of making a decision to rerack in 1996, Waterford 3's management would have relied on the allocations of plants that had not yet been acquired, was "clearly flawed." Id. Mr. Maret testified that Waterford 3 needed to rerack in the non-breach world because of its need for additional space, benefited from "resolving the Boraflex issue, and because "[i]t's easier to manage the entire on-site fuel management cycle, to receive fuel, to discharge fuel, and to handle fuel with the new, larger-capacity spent fuel pool compared to the lower-capacity original spent fuel pool." Tr. 2906.

Elements of Plaintiffs' Claim for Dry Fuel Storage

After completing the rerack in 1998, Waterford 3 eventually implemented an on-site dry fuel storage system. Plaintiffs' claim for damages for implementing dry fuel storage is based on nine work orders:

1) Dry Fuel Storage (Work Order N66105) - $10,153,377

2) Dry Fuel Storage Crane Upgrade (Work Order N66737) - $8,938,506[19]

3) Dry Fuel Storage Storage Pad (Work Order N66738) - $14,601,000

4) Haul Path Improvements (Work Order N66739) - $6,528,000

5) Dry Fuel Storage Security Modifications (Work Order N66740) - $1,245,000

6) Overpack Construction Pad (Work Order N66741) - $2,648,000

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trial testimony on 23 previous occasions, and has testified in 16 spent nuclear fuel cases. Id. at 4. Dr. Neuberger has also published extensively in economics and banking. Id. at Ex. 1 at 8-10.

[19] While Plaintiffs charged $8,938,506 to this work order, the parties have stipulated that Plaintiffs claim $8,505,653 for the fuel handling building crane upgrade, exclusive of $7,600 in allegedly unsupported costs and $8,413 in allegedly unrecoverable payroll loaders. Joint Stip. ¶ 6(b).

7) Fuel Handling Building and Plant Modifications (Work Order N66742) - $8,081,000[20]

8) Cask Systems (Work Order N66743) - $6,997,000

9) Dry Fuel Storage Campaign 2012 (Work Order N66920) - $8,033,000

Pls.' Post-Trial Br. 15-24; PDX 2. At trial, Mr. Greg Ferguson[21] testified that all of these work orders were issued due to Waterford 3's need for additional storage space as a result of DOE's failure to perform under the Standard Contract. Tr. 442-48. Mr. Laque testified that these costs would not have been incurred had Waterford 3 not implemented dry storage. Id. at 190-92.

The Process of Loading SNF for Storage Using the Holtec Cask System

Waterford 3 loaded its first three dry fuel storage casks in October 2011, and six more casks in 2012. Id. at 192-93. These casks are located near the plant buildings on an independent spent fuel storage installation ("ISFSI"). The ISFSI is a 14-inch thick concrete pad built on top of 1,044 60-foot long wooden piles, which were used to address the soil conditions at the plant, as it is located on the banks of the Mississippi River.[22] Id. at 632-33. Waterford 3 uses a Holtec HI-STORM 100S system for dry fuel storage. Id. at 194-95. There are three major components of this system – the HI-STORM overpack, the Multi-Purpose Canister, and a HI-TRAC transfer canister. Id. at 196-98; PDX 3 at 1.

The HI-STORM overpack is a steel shell filled with concrete that holds the Multi-Purpose Canister, providing radiation shielding and protection, when placed on the ISFSI. Tr. 196. The HI-STORM lid is also made of steel and concrete and is bolted to the body of the HI-STORM. Id. at 199. The Multi-Purpose Canister is a steel enclosure with a welded lid that holds 32 spent fuel assemblies in an internal basket. Id. at 196-97, 206-07. The HI-TRAC is used inside the fuel handling building to move and protect the Multi-Purpose Canister while it is being moved into the cask storage area to be loaded with fuel and is also used to transfer the Multi-Purpose Canister into the HI-STORM. Id. at 197-98. The HI-TRAC has lifting trunnions that attach to a device called a lift yoke, which itself can be attached to the fuel handling building crane. Id. at 209. Another feature of the HI-TRAC is a removable "pool lid" bottom that allows the Multi-Purpose Canister to be moved out of the HI-TRAC and into the HI-STORM. Id. at 210-11.

The HI-STORM cask is moved in and out of the fuel handling building by a "low profile transporter." Id. at 213; PDX 3 at 14. The low profile transporter is a device with six Hilman rollers that is pushed by another device called a "prime mover." Tr. 213-14. After being loaded

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[20] The parties have stipulated that Plaintiffs claim $7,240,114 for these items, exclusive of $16,277 the Government challenges as unrecoverable payroll loaders. Id. at ¶ 6(c).

[21] Mr. Ferguson currently works as an independent contractor at Waterford 3. Tr. 426. Prior to July 2013, he was employed by Entergy Operations as senior lead engineer. Mr. Ferguson began working at Waterford 3 in 1992 as a senior engineer. Id. at 426-27.

[22] Mr. Ferguson noted that 1,045 piles were actually used because one was broken during installation. Id. at 633.

with fuel and taken out of the fuel handling building on the low profile transporter, a wheeled vertical cask transporter is used to move the HI-STORM along a specially engineered pathway called the heavy haul path to the ISFSI pad. Id. at 215-16; PDX 3 at 16. The heavy haul path, which includes a turning pad that was put in place to allow the vertical cask transporter to make a 45 degree turn, was created so that Waterford 3 could use the Holtec cask system. Tr. 278-79.

Removing spent fuel from the spent fuel pool and eventually placing it on the ISFSI is a multi-step process. A HI-STORM is delivered by truck and concrete is poured between the inner and outer shells. Id. at 200; PDX 3 at 4-5. The concrete pouring is performed on site near the ISFSI. Tr. 234. When a loading campaign is ready to start, the vertical cask transporter is used to bring a HI-STORM containing an empty Multi-Purpose Canister via the heavy haul path to the fuel handling building. Id. Workers unbolt the HI-STORM lid and remove it, then open the doors to the fuel handling building rail bay and use the low profile transporter to push the HI-STORM and Multi-Purpose Canister into the fuel handling building. Id. at 234-35. The Multi-Purpose Canister is moved from the HI-STORM into the HI-TRAC, prepped, and partially filled with borated water. Id. at 235; PDX 3 at 27. The area between the HI-TRAC and the Multi-Purpose Canister is filled with demineralized water. Tr. 282.

Inside the cask storage area, which is filled with water, is the variable elevation cask support pedestal ("VECASP"). The VECASP is a two-elevation platform that is unique to the Holtec system. Id. at 219. The very bottom of the cask storage area is at elevation 0.5 feet. The lower VECASP level is at 4.25 feet, while the upper position is at 18.52 feet. The elevation of the floor of the fuel handling building is 46.25 feet. DDX 5 at 9. Therefore, the cask storage area is over 40 feet deep.

The lift yoke is attached to the HI-TRAC lift trunnions, then attached to the main hook of the fuel handling building crane, lifted, and placed on the upper position of the VECASP in the cask storage area. Tr. 236-37. Workers add a lift yoke extension to the lift yoke to give more reach so that the crane hook does not enter the spent fuel pool water. Id. at 237. As Mr. Laque explained, Waterford 3 does not want the crane hook to go into the water because of "very high concentration[s] of boric acid in the spent fuel pool," which degrades the carbon steel of the hook. Id. After the lift yoke extension is added, the HI-TRAC, containing the Multi-Purpose Canister, is rotated and inserted into the cask storage area to rest on the lower level of the VECASP. Id.

Using the spent fuel handling machine underwater, the operator places fuel assemblies inside the Multi-Purpose Canister. PDX 3 at 29. Workers then move the HI-TRAC from the lower to the upper position of the VECASP, remove the lift yoke extension, and use the crane and lift yoke to bring the Multi-Purpose Canister lid over and lower it onto the Multi-Purpose Canister inside the HI-TRAC. Id. at 31; Tr. 242. Then, the entire HI-TRAC and Multi-Purpose Canister are removed from the water of the cask storage area, the radiation dose is monitored, and the HI-TRAC and lift yoke are sprayed down to remove contamination. Tr. 255.

The HI-TRAC and Multi-Purpose Canister are lifted out of the cask storage area and moved into the cask decontamination area. Id. at 255-56; PDX 3 at 36. The cask decontamination area contains a work platform and pedestal that allows workers to comfortably access the HI-TRAC containing the Multi-Purpose Canister. Tr. 220. The work platform in the cask decontamination area was designed for the unique dimensions of the Holtec HI-TRAC. Id.

at 694-95. The crane operator places the HI-TRAC onto the cask decontamination pit platform and, using the work platform, workers decontaminate the area to prepare to weld the MPC lid. Id. at 257; PDX 3 at 32. An automatic welding machine is brought in and the operator welds the lid onto the MPC. Tr. 259; PDX 3 at 38. The welding is then tested for flaws. Tr. 261-62. After the welding, the water is removed from the inside of the MPC by hooking up a helium system using hoses to the Multi-Purpose Canister's internal drain line. Id. at 262-63; PDX 3 at 39. The inside of the Multi-Purpose Canister is further dried with a vacuum drying system. Tr. 262. Using the helium system, helium is then injected into the MPC. Id. at 263.

During this loading process, the HI-STORM has remained in the rail bay. A device called the mating device is placed on top of the HI-STORM. Id. at 264. The HI-TRAC, still containing the Multi-Purpose Canister, is placed on top of the mating device and the HI-STORM – a configuration known as the stack-up position. Id. at 266; PDX 3 at 41. Workers use the mating device to remove the HI-TRAC's lower pool lid. Using downloader slings, the Multi-Purpose Canister is lowered from the HI-TRAC into the HI-STORM. Tr. 267-68; PDX 3 at 42. The slings are then removed, the pool lid is replaced onto the HI-TRAC, and the HI-TRAC is removed from the stack-up and placed back into the cask decontamination area to await the next canister. Tr. 269-70. The mating device is removed from the HI-STORM, the low profile transporter is used to take the loaded HI-STORM out of the fuel handling building, and the vertical cask transporter moves the HI-STORM along the heavy haul path to the ISFSI pad. Id. at 272. The HI-STORM lid is installed and bolted on. Id. at 276. The HI-STORM containing the loaded Multi-Purpose Canister will sit on the ISFSI pad for the foreseeable future, as no DOE repository is in place.

Challenged Site Modifications Needed for Dry Storage Activities

In order to implement dry storage, Plaintiffs made certain modifications to the plant equipment and fuel handling building. Plaintiffs claim damages of $8,505,653 for upgrading the crane in the fuel handling building to be single-failure-proof. Single-failure-proof means that the crane is made so that no single component could fail and allow the load to drop. Id. at 607-08. The load capacity of the crane remained at 125 tons before and after the upgrade. Id. at 670-71. If a crane is not single-failure-proof, a cask could potentially be dropped, and the cask cannot be lifted beyond the bounds of an applicable cask drop analysis. A cask drop analysis analyzes the effect of a drop on the cask, the cask contents, and the plant structure, such as the floor. Id. at 1647.

In addition to potentially causing a dangerous release of spent fuel, performing a lift that goes beyond the parameters of the cask drop analysis would violate Waterford 3's safety requirements. Waterford 3's FSAR for its license included a cask drop analysis of a Fort Saint Vrain-1 ("FSV-1") cask, which weighs 47,000 pounds, from a height of 43.25 feet. Id. at 1577. This analysis was done to understand the potential damage to the building structure from this type of drop. Id. at 825. Waterford 3 did not review this cask drop analysis in order to use the Holtec system, because the Holtec casks are much heavier. Id. at 805. It was necessary to upgrade the crane to single-failure-proof because the HI-TRAC "is not designed for cask drop," meaning there was "no analysis showing that the [Multi-Purpose Canister] would survive a

drop."[23] Id. at 671. Mr. Ferguson credibly testified that the crane was upgraded to allow for use of the Holtec system, not to save on costs or reduce personnel exposure. Id. at 672.

Implementing dry cask storage required Plaintiffs to remove the racks and support platform that had been located in the cask storage area. Id. at 692-93. Additionally, Plaintiffs purchased the work platform that is currently used in the cask decontamination area. Id. at 694. Waterford 3 had a structural and seismic analysis done to ensure that the Holtec cask equipment would not damage the building structure during a seismic event and performed 3D modeling of the cask handling path and other locations within the fuel handling building. Id. at 667, 2127, 2678; PX 850 at 7676. Plaintiffs also had to request a license amendment from the NRC to change the plant's technical specifications to allow the handling of the 10,000 pound Multi-Purpose Canister lid over the spent fuel. Tr. 428-29. The parties also dispute whether Plaintiffs should receive damages for the purchase of the VECASP, lift yoke extension, and lift yoke stand, which is used to store the lift yoke.

Plaintiffs' Model of the Non-Breach World Using DOE Transportation Casks

Under the Standard Contract, DOE was required to provide a suitable transportation cask. This provision stated:

> DOE shall arrange for, and provide, a cask(s) and all necessary transportation of the SNF and/or [high-level waste] from the Purchaser's site to the DOE facility. Such cask(s) shall be furnished sufficiently in advance to accommodate scheduled deliveries. Such cask(s) shall be suitable for use at the Purchaser's site, meet applicable regulatory requirements, and be accompanied by pertinent information, including, but not limited to, the following:
>
> (a) written procedures for cask handling and loading, including specifications on Purchaser-furnished cannisters [sic] for containment of failed fuel;
>
> (b) training for Purchaser's personnel in cask handling and loading, as may be necessary;
>
> (c) technical information, special tools, equipment, lifting trunnions, spare parts and consumables needed to use and perform incidental maintenance on the cask(s); and
>
> (d) sufficient documentation on the equipment supplied by DOE.

JX 1 at Art. IV.B.2. In accordance with the delivery commitment schedule and final delivery schedule forms, the Purchaser was to select the shipping mode – either truck, rail, or barge.

The regulations at 10 C.F.R Part 71 govern the transportation of nuclear fuel, while Part 72 governs the storage of spent fuel. Tr. 298-99, 676-77. The Holtec HI-TRAC, HI-STORM,

[23] Mr. Ferguson testified that Entergy was able to have impact limiters "with their building set up," i.e. that the River Bend plant had a building set-up that allowed it to use load limiters to absorb the load of a potential drop, instead of single-failure-proofing the crane. Id. at 672.

and Multi-Purpose Canister are not licensed for shipment but are licensed for storage under Part 72. Id. at 675, 862. The Multi-Purpose Canister is a dual-purpose canister that can be used for storage and is compatible with another Holtec item called the HI-STAR, which can be used, with the proper licensing, for transportation of spent fuel. Id. at 298-99. However, in order to use the Multi-Purpose Canister for transportation, a Part 71 license must be obtained. Id. at 864-65.

A cask licensed under Part 71 for transportation must be able to survive a 30-foot drop and have been analyzed to ensure that it can withstand such a drop. Id. at 680, 797. There are two types of transportation casks – truck casks and rail/barge casks. Id. at 1561. A truck cask is smaller and can be transported on highways because the "gross vehicle weight, including the loaded cask does not exceed 80,000 pounds." Id. at 2627; PX 1 at 21, n.40. A rail cask is larger and can hold more fuel assemblies. Tr. 1636.

Ms. Eileen Supko was asked to develop a plausible description of DOE performance for spent fuel acceptance and transportation from Waterford 3, assuming that DOE had begun performance in 1998. Id. at 1477. The purpose of this analysis was to determine what plant modifications and actions would have been necessary in the non-breach world. Ms. Supko identified the actions and modifications that were made at Waterford 3 in order to use the Holtec system in the breach world, identified "the general features of a plausible DOE transportation cask for acceptance of spent fuel from Waterford," and then identified the actions and modifications that would have been necessary for Waterford 3 to handle this plausible DOE cask. Id. at 1477-78.

In order to determine what a plausible DOE transportation cask would have been, Ms. Supko analyzed the physical features at Waterford 3 and compared these to the known features of DOE casks that were under development and casks that were in use for transport in the 1990s. Id. at 1478. Ms. Supko also reviewed the Waterford 3-specific Facility Interface Capability Assessment ("FICA"), a report created by DOE for each nuclear plant that discussed the plant's cask handling capability and the ability to handle the various casks under development. Id. at 1479. Finally, Ms. Supko reviewed Waterford 3's final safety analysis report, the FSV-1 cask drop analysis, and plant drawings, and spoke with Entergy personnel regarding cask handling. Id. at 1480-81.

Ms. Supko concluded that "had DOE begun performance in 1998 . . . , Entergy could have, and plausibly would have, selected truck shipment for acceptance of [spent nuclear fuel] from the Waterford site." PX 1 at 9. Ms. Supko only analyzed legal weight truck casks, instead of heavier rail casks, "because the only cask drop analysis performed for Waterford was for a legal weight truck cask, and because the use of a legal weight truck cask was a plausible choice." Id. at 18. Based on conversations with Entergy personnel and a review of the Waterford 3-specific Facility Interface Capability Assessment report, Ms. Supko determined that Waterford 3 could handle a DOE transportation cask with a maximum diameter of 11 feet, 1 inch, and a maximum length of approximately 18 feet. Id. at 10.

Although it was not possible to identify the specific transportation cask design that would have been provided by DOE for use at Waterford 3, Ms. Supko found it plausible that DOE would have brought a truck cask with similar dimensions to five casks that were developed by

DOE or were certified for transportation in the 1990s.[24] Id. at 18-22. These casks weigh between 23 and 27.1 tons, have lengths between 188 and 208 inches (without impact limiters),[25] diameters between 28 and 48.31 inches, and can hold 1 to 4 spent nuclear fuel assemblies. Id. at 22. Ms. Supko noted that the Waterford 3 cask drop analysis was performed assuming a 23.5 ton (47,000 pound) FSV-1 cask dropped from a height of 43.25 feet. Id. at 24. Additionally, a Part 71 transportation cask must be designed to withstand a 30-foot drop on to an unyielding surface. Id. Ms. Supko concluded that this cask drop analysis would still cover the use of an approximately 30-ton DOE cask, such that another cask drop analysis would not need to be performed, because in handling a DOE cask, Waterford 3 would only have had to perform a 20-foot lift. Id. at 24.

Ms. Supko modeled how Waterford 3 would have loaded a DOE-supplied cask in the non-breach world. The DOE cask would have arrived via a DOE transport vehicle at the fuel handling building rail bay. Id. at 25. Ms. Supko asserted that DOE would have supplied a cask lift yoke, slings, and other equipment pursuant to the Standard Contract, which specified that DOE would provide "technical information, special tools, equipment, lifting trunnions, spare parts and consumables needed to use and perform incidental maintenance on the cask(s)." Id.; JX 1 at Art. IV.B.2.[26] The DOE cask would have been brought into the fuel handling building through Gate 4 and placed in the cask decontamination area to be washed down. PX 1 at 25. The DOE cask lid would have been removed with the crane auxiliary hook, which has a 15-ton capacity, and set aside. Id.

Before moving the DOE cask to the cask storage area, the cask storage area "would have been drained of water and bulkhead Gates 3A and 3B . . . would have been removed to facilitate transfer of the DOE cask from the [cask decontamination area] to the [cask storage area]." Id. The DOE cask would then have been moved into the cask storage area using the crane. Id. Gates 3A and 3B would have been reinstalled, the interior of the DOE cask filled with borated water, and the cask storage area would have been refilled. Id. Gate 1, between the cask storage area and the spent fuel pool, would have been removed to allow spent nuclear fuel assemblies to be placed into the DOE cask. Then, the DOE cask lid would have been lifted by the crane auxiliary hook and lowered into place on the DOE cask.

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[24] These five casks were the General Atomics GA-4 and FSV-1, the NAC International NAC-LWT and NLI 1/2, and the Westinghouse Titan. Very few of these casks ever existed. General Atomics has completed NRC certification of the GA-4, but has never fabricated any of these casks. NRC regulations did not allow for fabrication of the NLI 1/2 and the FSV-1 after August 31, 1986. NAC International owns five NLI 1/2 casks and eight LWT casks. Three FSV-1 casks were fabricated. The FSV-1 was not certified to transport fuel from pressurized water reactors like Waterford 3.

[25] Impact limiters are "removable external protective structures" "that reduce the mechanical forces imposed on the package under accident conditions." PX 1 at 23.

[26] In their post-trial briefs, Plaintiffs do not assert that the lift yoke would have been provided by DOE and instead argue that purchasing it would not have been necessary in the non-breach world because the cask storage area would have been drained. See Pls.' Post-Trial Reply Br. 20.

Gate 1 would have been replaced and the water in the cask storage area would have been drained again. Id. The DOE cask would have been prepared for shipping, by draining the borated water, backfilling the cask interior with helium, and installing and tightening all remaining cask lid bolts for transport. Id. Using the crane, the DOE cask would have been moved into the cask decontamination area through Gates 3A and 3B and decontaminated. Id. at 26. Finally, the DOE cask would have been lifted through Gate 4 into the rail bay and loaded onto a DOE transport vehicle. Id.

Based on this opinion of how a DOE cask would have been loaded in the non-breach world, Ms. Supko concluded that Waterford 3 would not have had to make modifications to the fuel handling building or take other actions it had to take in the breach world. Ms. Supko found that Waterford 3 would not have had to upgrade the crane to single-failure-proof because the height of the lift envisioned by her model coupled with the use of a 30-ton DOE cask fell within the parameters of Waterford 3's existing cask drop analysis using the FSV-1 cask. Additionally, because the 30-ton weight of the DOE cask is not close to 25% of the 125-ton capacity of the crane, according to Mr. Ferguson, there would be an "additional margin in the [crane] safety factors." Id. at 28. Furthermore, because the DOE cask lid would have been bolted in place and fully torqued while the cask was in the cask storage area, if the cask were dropped while being moved to the cask decontamination area, it would be leak-tight with no possible release of radiation. Id.

Ms. Supko also found that Waterford 3 would not have had to obtain an NRC license amendment to lift heavy loads, i.e. the cask lids, over the spent fuel pool, as the weight of the truck cask lid would have been less than 2,000 pounds. Id. at 27-28.[27] Ms. Supko testified that the truck casks she examined had lid weights from 860-1510 pounds and thus, even when combined with the weight of the auxiliary hook and load block, this weight would remain under

[27] The NRC regulates the movement of heavy loads over certain areas at nuclear power plants, including areas where the spent fuel is located. Tr. 768. An NRC regulation, NUREG 612, governed control of heavy loads at nuclear power plants. Id. at 608. During the implementation of its dry cask storage project, Waterford 3 obtained a license amendment to lift heavy loads over the spent fuel assemblies, specifically "over the HI-TRAC transfer cask as it sits in the cask storage area, and specifically the HI-TRAC transfer cask lid." Id. at 1638-39. Prior to this amendment, loads in excess of the 2,000 pound limit could not be lifted over spent fuel, as this limit was part of Waterford 3's operating license. Id. Waterford 3's administrative or procedural definition of a heavy load is 1,500 pounds. Id. at 815. Waterford 3's Final Safety Analysis Report ("FSAR") has a higher definition of heavy load – 2,000 pounds. Id. at 815-16. Waterford 3's July 23, 1998 design change package, which was created to gain approval from management to make changes to the plant for the rerack project, specified that a heavy load was defined as 1,500 pounds, including the block, load, rigging, and hook. Id. at 754-55. The crane has an auxiliary hook, weighing 625 pounds, which includes the weight of the crane load block, that is rated for 15 tons. Id. at 815. The main hook of the crane is rated for 125 tons. Id. at 670. Mr. Ferguson testified that the total weight of the auxiliary hook and block is 400 pounds. However, Ms. Supko, quoting from Waterford 3's heavy load procedures, noted that the weight of these two items combined is 625 pounds. Id. at 1640.

2,000 pounds. Tr. 1595. She also stated that it was plausible that a truck cask could have been used that had a lid weight that fell under both the 2,000 pound limit in Waterford 3's technical specifications and its 1,500 pound procedural limit. Id.

Ms. Supko also opined that the VECASP, lift yoke, lift yoke extension, and lift yoke storage hangar would not have been needed because there would have been no issue with potentially dipping the hook and other crane parts into borated water, as her model had the cask storage area water drained. PX 1 at 29. Ms. Supko posited that the work platform would not have been necessary because DOE had a bolted cask lid and thus no access to the top of the cask for inspection and welding would have been necessary. Id. Ms. Supko stated that "Entergy could have utilized scaffolding to support closure operations of the DOE cask in the [cask storage area], such as the scaffolding used in the [fuel handling building] [r]ail [b]ay during stack up operations." Id.

Ms. Supko was instructed by counsel not to consider cask loading costs in her comparison of the breach and non-breach world. PX 1 at 1. Ms. Supko did not attempt to identify "the number of assemblies that would have been transported in the DOE cask in this non-breach scenario" because this "would only be important if it were necessary to quantify differences in cask loading costs between the non-breach and breach worlds." Id. at 29. Ms. Supko also did not consider worker radiation dose or the amount of time it would take to load a cask in her model. Tr. 1622.

Ms. Supko's model of the non-breach world required operational gates, particularly Gates 3A and 3B. However, in the breach world, Gate 3A is welded closed to stop leaking. Id. at 308. Mr. Ferguson testified that Gate 3A was welded in the beginning of plant operations because plant personnel were never able to get the leakage below 30 gallons per hour. Id. at 611-12, 750. Multiple unsuccessful attempts were made to stop the leaking. Id. at 750-51. Additionally, Gates 1 and 2 leaked. Id. at 703, 752. Mr. Ferguson had never seen Gates 1 and 2 installed or Gates 3A and 3B removed. Id. at 696, 747. Ms. Supko concluded, based upon discussions with Mr. Ferguson, that Entergy would have repaired Gate 3A by removing the welds and replacing the gate seals. Id. at 695; PX 1 at 29.

Mr. Laque estimated that removal of Gates 3A and 3B would take approximately 1.5-2 hours per gate.[28] Tr. 371. This estimate did not include the time to deflate and reinflate the seals around the gates. Id. at 372. It would also take approximately 1.5-2 hours, possibly longer, to reinstall the gates. Id. at 372-73. Mr. Laque further estimated it would take 4-6 hours to remove Gate 4 using a six-man crew. Id. at 376.

Based on Ms. Supko's conclusion that Gate 3A would necessarily have been repaired to comport with her model of the non-breach world, Mr. Metcalfe computed an offset for gate repair of $660,338. He stated that this offset was based on facts provided by Mr. Ferguson about the amount of manpower, contractor personnel, days needed, and other information. Id. at 1875-76. Therefore, based on Ms. Supko's opinion, Plaintiffs claim damages of $8,505,653 for the

[28] Mr. Laque's estimates were based on each gate being a separate section. Mr. Ferguson testified that Gate 3A is made out of two pieces on top of each other with a horizontal seam.

crane upgrade and $7,240,114 for the other fuel handling building modifications and actions, minus the gate offset.

Defendant's Expert Opinion on Ms. Supko's Non-Breach World Model

According to Gregory Maret, Defendant's expert in nuclear power plant operations and management,[29] Plaintiffs would have upgraded the crane in the non-breach world as well as in the actual world, and would also have performed the other modifications and actions, such as obtaining the NRC license amendment for heavy loads. Id. at 2616, 2674-78. Mr. Maret had several overall objections to Ms. Supko's analysis. Mr. Maret opined that Plaintiffs' representation of the non-breach world would have led to "potentially risky behaviors" and had "significant gaps" that were not consistent with Entergy's business practices reflected in its cost/benefit analyses, safety values, and risk management. Id. at 2620-21. In Mr. Maret's opinion, Ms. Supko's analysis was overly constrained to try to fit within Waterford's FSAR [Final Safety Analysis Report] documentation, meaning that her analyses only "considered what activities could have been performed at Waterford while limiting modifications, not what modifications Waterford would have implemented." Id. at 2624; DDX 5 at 4. Additionally, Ms. Supko did not consider the benefits of modifications over the life of the plant. Tr. 2623-24.

One of the major problems that Mr. Maret found in Ms. Supko's model was her use of a low-capacity truck cask. Mr. Maret concluded that the only cask that could have been used at Waterford 3 under Ms. Supko's model had the capacity of one fuel assembly, because Ms. Supko did not consider "the licensing effort that would be necessary to qualify casks with heavier lids," and this one-assembly cask was the only one with a lid that could meet the non-heavy load criterion of being under 1,500 pounds. Id. at 2622. Mr. Maret testified that using a cask with this low capacity instead of a larger rail cask created costs that Ms. Supko did not take into account. Id. at 2622-23. Mr. Maret opined that using a one-assembly cask required shipping two casks per week to keep up with the discharge of spent fuel from the reactor, creating scheduling problems with the other activities conducted in the fuel handling building. Id. at 2629. Mr. Maret testified that Waterford 3 appeared to have been designed for the handling of large casks, as there was rail access to the site and the crane was rated for 125 tons. Id. at 2630. Mr. Ferguson also testified that the plant's design basis allowed for rail loading. Id. at 606.

Mr. Maret found that Ms. Supko's model of draining the cask storage area and conducting cask closure activities in the drained cask storage area created serious problems that she did not take into account. Mr. Maret concluded that Ms. Supko did not address concerns about reversing the welding on Gate 3A and opined that it would be difficult to "convince the plant operations review committee and plant management that removing the seal weld [would be] a safe and appropriate thing to do at that nuclear power plant."[30] Id. at 2639-40. Removing

[29] Mr. Maret's expertise included plant modifications, management of spent nuclear fuel, regulatory compliance, and transfer of fuels from wet to dry storage.

[30] Mr. Maret had served as the vice chairman of the plant operations and review committee at the Yankee Rowe plant. Id. at 2586-87. According to Mr. Maret, the plant operations review committee "is the body that reviews proposed changes to the design of the nuclear facility and makes recommendations to the senior manager" whether to approve or disapprove changes based on their "risk and safety merits." Id. at 2587.

the weld and still not being able to fix the leaks would risk an "uncontrolled release of radioactive material" and would be a "violation of the license for operating" the plant, something the plant managers would "do everything they can to make sure" never happened. Id. at 2640. Furthermore, this model required workers to enter the dry cask storage area, which was hot, confined, not intended for people to work in, and did not have any means of access. Id. at 2643-44. Second, the walls of the cask storage area and the cask itself would have been radiologically contaminated, requiring ventilation or supplied air for workers. Id. at 2644. Mr. Maret stated that Ms. Supko did not address the water transfer time of pumping 50,000 gallons of water out of the cask storage area and the cost of operating these pumps. Id. at 2647. According to Mr. Maret, Ms. Supko did not discuss leakage from Gate 1, was not clear whether the cask storage area would be fully or partially drained, and did not address increased radiation exposure from the loaded fuel resulting from lowering the water level above the cask. Id. at 2634-37.

Mr. Maret further stated that whether or not the hypothetical DOE cask had impact limiters was something that should have been considered by Ms. Supko, but was not. Id. at 2638-39. For example, the GA-4 cask, one of the casks Ms. Supko stated could plausibly have been used at Waterford 3, had impact limiters that prevented access to its lift trunnions, which are needed to move the cask from a horizontal to a vertical position. Id. at 2638. However, Ms. Supko did not analyze how impact limiters would have been handled in the non-breach world.

Based on these stated problems with Ms. Supko's model, Mr. Maret concluded that, assuming operation through 2024, approximately 600 truck cask loading evolutions would have had to have been performed and the gates would have had been moved an equal amount of times. DX 177 at 6-7.[31] Mr. Maret determined that Waterford 3 would have chosen to make the upgrades that it did in the breach world because it would avoid the costs created by not taking these actions and because this choice offered reduced risk and increased personnel safety. Id. Mr. Maret opined that using Ms. Supko's non-breach world scenario would not have been consistent with prudent plant decision-making. Id. at 6.

Mr. Maret asserted that Waterford 3 would have upgraded its crane to single-failure-proof had DOE timely performed. Mr. Maret believed that the existing Waterford 3 cask drop analysis using the FSV-1 cask would not have covered the potential drop of a DOE cask. Tr. 2625-26. Mr. Maret noted that Ms. Supko "essentially credit[ed] the impact limiters in her adoption of a population of casks in her work, because they all require impact limiters to satisfy the analyses required in 10 C.F.R. Part 71, but she never address[ed] how those impact limiters are going to be handled inside the Waterford [p]lant." Id. at 2626. Therefore, Mr. Maret concluded that upgrading the crane in the non-breach world allowed Waterford 3 to avoid performing drop analyses and taking mitigation measures such as redundant rigging. DX 177 at 14. Upgrading the crane would have allowed Waterford 3 to use a large-capacity rail cask, which was possible at the site. Furthermore, even assuming the use of a DOE truck cask, upgrading the crane would have been a prudent decision to avoid all of the costs and safety issues that would have been incurred by fixing, maintaining, and moving the gates during cask loading, draining the cask storage area, constructing and moving scaffolding in the cask storage area, and having workers enter the drained and contaminated cask storage area. Id. at 14-17.

[31] These numbers increased to 1,000 if the plant's license was extended to 2044. DX 177 at 7.

Mr. Maret also opined that Waterford 3 would have needed the VECASP [variable elevation cask support pedestal] or similar device and lift yoke items to load DOE-supplied transportation casks. Id. at 18. Without the VECASP and lift yoke, it would not be possible to lower a cask to the bottom of the cask storage area without submerging the steel crane components. Id. Ms. Supko's approach avoided the use of these items by draining the cask storage area. However, Mr. Maret opined this approach came with the significant costs associated with the gate removal and the time and manpower to drain the water, and thus was not a reasonable alternative to using a platform and lift yoke. Id. at 18-19. Mr. Maret further concluded that the following modifications and actions would have taken place to load any cask at Waterford 3, including a DOE-supplied cask: removal of the racks and associated platform in the cask storage area, the use of a work platform in the cask decontamination area, the structural and seismic evaluations of the fuel handling building, 3D modeling of the cask handling path and fuel handling building, and the license amendments to move heavy loads over the spent fuel and loaded cask and to load spent fuel into a cask. Id. at 24.

Mr. Maret acknowledged that if DOE had performed and Waterford 3 had chosen not to rerack, there would have been no racks in the cask storage area that needed to be removed in the non-breach world. Tr. 2802. He also acknowledged that had DOE performed, the same VECASP would not have been used, and that Holtec had provided lift yoke items that were designed to connect to the HI-TRAC. Id. at 2803-04. Mr. Maret did not know whether the Holtec lift yoke would work with a DOE cask. Furthermore, Mr. Maret accepted that the work platform in the cask decontamination area was designed to accommodate the specific diameter of the Holtec HI-TRAC and that a new platform would have to be procured or modifications made to the Holtec platform to match up with the DOE cask when DOE performs. Id. at 2808. Similarly, Mr. Maret acknowledged that the seismic and structural evaluations and the 3D modeling that had been performed had considered the specific weight, dimensions, and center of gravity of the Holtec system components and that these analyses might have to be redone to use DOE cask parameters when DOE performs. Id. at 2809-10, 2812-13. Mr. Maret stated that Waterford 3 may have to make a claim for damages from the Government to pay for a second version of these analyses when DOE performs and they have to be redone. Id. at 2811, 2813. Mr. Maret did not know the weight of the lid of the cask that DOE would bring to Waterford 3 and conceded that if the lid, along with the hook and rigging, did not qualify as a heavy load, no license amendment would be needed. Id. at 2814-15.

Fact Witness Testimony Addressing Characteristics of the Cask Storage Area

Mr. Laque testified regarding Entergy's confined space program, which is designed to protect employees from actual or potential hazards when entering "permit-required confined spaces" and provide guidance "for entry into spaces other than permit-required confined spaces." Id. at 318. The program defined "confined space" as "any area which may be occupied by personnel which have all of the following characteristics:"

> (a) large enough and so configured that an employee can bodily enter and perform assigned work;
>
> (b) limited or restricted means of entry or exit; and
>
> (c) not designed for continuous human occupancy.

Id. at 367; JX 19 at 5402. Additionally, the program defined "permit-required confined spaces" as those which had all of the characteristics of a confined space and one or more of the following characteristics:

(a) Contains or has the potential to contain a hazardous atmosphere

(b) Contains material that has the potential for engulfing an entrant

(c) Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section, or

(d) Contains any other recognized serious safety or health hazard.

JX 19 at 5404-05. Mr. Laque stated that entry into a confined space required atmospheric sampling and a pre-job brief, while entry into a permit-required confined space was more restrictive and required requesting entry from supervisors. Id. at 5412; Tr. 404. Mr. Laque testified that it appeared that the drained cask storage area would meet the definition of a confined space but not a permit-required confined space. Tr. 405.

Mr. Laque also testified regarding radiological contamination of the walls of the drained cask storage area. The practice of the plant would be to assume that the surface of the cask storage area was radiologically contaminated because assuming otherwise could result in unintentionally exposing people to radiation. Id. at 362-63. Mr. Laque stated that the gates that had come into contact with the water of the spent fuel pool would be considered contaminated until surveyed and proven not to be contaminated. Id. If the gates were going to be removed from the contaminated area, they would have to be decontaminated or wrapped up to stop the contamination from spreading. Id. at 373-74.

Mr. Laque was not sure if the cask storage area could be drained and had never seen this done since the plant began operations. Id. at 308. Mr. Ferguson did not know how long it would take to drain the cask storage area and acknowledged that the cask storage area did not have built-in features to allow workers to access the bottom. Id. at 753. Mr. Ferguson stated that he was not sure where Entergy would put the water drained from the cask storage area, but that this water could be put back into the spent fuel pool and the spent fuel pool could be drained down to make room for the water from the cask storage area. Id. at 818.

In Mr. Maret's opinion, it did not make sense for Waterford 3 to have used low-capacity truck casks in the non-breach world because the plant had the infrastructure to allow for the use of large rail casks. DX 177 at 14. Mr. Ferguson testified that rail access had existed during the original construction, but there had not been rail access since he had started working at Waterford 3 in 1992. Tr. 606. Waterford 3 currently does not have usable rail access. Mr. Maret, however, opined that this rail access could have been reestablished. Id. at 2630. In October 2004, Waterford 3, in a "dry fuel storage overview" document, evaluated three options for further fuel storage to maintain full core reserve – additional reracking, building an ISFSI,

and shipping the spent fuel to another plant. PX 810 at 6814. [32] The author of this document noted that if Waterford 3 chose to ship its spent fuel elsewhere by rail, "considerable work on the rail spur from the plant [would] be necessary" because "[t]he current rail spur has not been used since the early 1980s" and "[t]he railroad ties along the 0.5 mile path to the site boundary have seriously degraded and [were] probably unfit for use." Id. Assuming the rails and rail bed were still acceptable for use, the cost to repair the rail line to the site boundary was estimated to be $250,000, using a metric of $1 million per mile. Id. Additionally, although there was a rail head one mile from the plant, the condition of the rail line between the site boundary and the rail head was also assumed to be in a degraded condition. Id. at 6814-15.

Cask Loading Costs

The Government challenges $3,966,282 in costs Plaintiffs incurred for loading the spent nuclear fuel into dry storage canisters. This amount was derived from work orders N66920, N09518, and N09588. DX 177 at 28. Under the Standard Contract, "[t]he Purchaser shall arrange for, and provide, all preparation, packaging, required inspections, and loading activities necessary for the transportation of [spent nuclear fuel] . . . to the DOE facility." JX 1, Art. IV.A.2(a). The Standard Contract thus required utilities to pay for cask loading costs.

The Government has admitted that in order to accept canistered fuel from Waterford 3, an amendment to the Standard Contract will be necessary "to define the terms and conditions for the acceptance of [spent nuclear fuel] in the canisters in which it is stored." PX 1066 at 13. With respect to its knowledge of the terms of such an amendment, the Government stated:

> While precise terms of any amendment to the Standard Contract for DOE acceptance of [spent nuclear fuel] that has been loaded into interim dry storage at Waterford 3 are unknown, the general parameters of such an amendment are known. The terms of the contract amendment would deem canistered fuel acceptable and determine the schedule for acceptance based upon the waste acceptance capability of the [spent nuclear fuel] storage and disposal facilities to be considered pursuant to the NWPA and applicable licensing requirements. No financial consideration beyond that which is required pursuant to the Standard Contract would be required per the terms of the amendment. The final design of the storage and disposal facilities to be constructed pursuant to the NWPA may require additional terms that cannot be defined at the present time.

Id. at 14. Additionally, the Government admitted that without an amendment to the Standard Contract, DOE could not accept canistered fuel for transport and disposal, but "DOE expects that, before DOE beings performance, it will execute a contract amendment to be able to accept canistered fuel for transport and disposal from Waterford 3." Id. at 15.

The Contracting Officer for all Standard Contracts, Mr. Zabransky, testified that the fuel on the Waterford 3 ISFSI was stored in multi-element sealed canisters and that "the Department of Energy's position has been since 1992 that the [S]tandard [C]ontract does not cover the

[32] Mr. Ferguson testified that he reviewed this document when he started working on the dry fuel storage project in 2006, and that the project manager at the time would have been the lead drafter. The document does not contain an author's name. Tr. 598-99.

acceptance of spent fuel while stored in multi-element sealed canisters." Tr. 1102. Furthermore, in the absence of an amendment to the Standard Contract, the utility would have to unload its spent fuel and reload it into DOE-provided transportation casks when DOE performs. Id. at 1102-03.

Plaintiffs argue that if they are not awarded cask loading costs, they will be forced to pay twice for loading fuel, once to put it into the canisters and then again to recanister it when DOE arrives. Mr. Maret opined that by loading its spent fuel into dual-purpose canisters, Waterford 3 has packaged the spent fuel for transfer to DOE. Id. at 2680; DDX 5 at 19. Mr. Maret stated that the multi-purpose canisters are ready to be put into a transportation package, instead of the storage package, and shipped to DOE. Tr. 2680-81. In his expert report, Mr. Maret clarified that the multi-purpose canisters can be transported under the existing license for the Holtec HI-STAR transportation package. DX 177 at 26.

Mr. Maret acknowledged, however, that while the canisters were designed to be dual-purpose, they were not currently licensed for shipment of the Waterford 3 fuel. Tr. 2831. Furthermore, Mr. Maret testified that not all of the loading activities for the Holtec canisters would have been the same as required to load a DOE cask and that there would be "a number of differences." Id. at 2878-79. Mr. Maret agreed that the costs to load a DOE bolted cask and a Holtec welded cask would not be identical and that a DOE cask would not require the stack-up operation. Id. at 2879, 2883.

Neither party's expert quantified cask loading costs in the non-breach world. Mr. Maret did not offer an opinion about what it would have cost to load, close, and handle DOE casks. Id. at 2884. Ms. Supko was instructed by counsel not to consider cask loading costs in comparing the breach and non-breach world cask loading operations. PX 1 at 29.

Mr. Maret testified that it was reasonable to expect that the loaded canisters would be accepted by DOE because it made "practical sense" that DOE would not force the utilities to reopen their canistered fuel. Tr. 2681-82. Mr. Maret stated that this opinion was based on his review of Entergy documents regarding the decision to fund the dry fuel storage project, which indicated that one of the benefits of using the Holtec dual-purpose system was that the fuel would not have to be repackaged and could be sent directly from the ISFSI to DOE.[33] Id. at 2682-83. Mr. Maret also believed that the actions of the nuclear industry support his view. For example, he relied on a 2008 Electric Power Research Institute report stating its view of DOE's plans that dual-purpose canisters would be shipped to Yucca Mountain, where DOE would open them for repackaging and storage. DX 177 at 26; DDX 5 at 19. Furthermore, Mr. Maret reviewed submissions that different plants have made to the NRC documenting their estimated costs of decommissioning. Tr. 2686; DX 177 at 26-27. Because these estimates have not included the costs of unloading the canisters and repackaging the spent fuel, Mr. Maret concluded that the utilities have assumed that DOE will pick up canistered fuel from their ISFSIs.[34]

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[33] Mr. Maret also relied on a 1990 Entergy Spent Fuel Storage Study. Id. at 2684.

[34] Mr. Maret also noted that the actions of prematurely shut down plants also demonstrated their assumption that DOE will accept their canistered fuel, as these plants have placed all of

However, the canisters may not meet the Part 71 transportation licensing requirements or may not be transportable by the time DOE performs. Tr. 864-89. The spent fuel cannot remain on the ISFSI forever, as the multi-purpose canister steel cladding will degrade over time. Id. at 865. There are specific requirements for fuel that can be placed into a Part 71 canister, and fuel selected to be placed into a Part 72 storage canister may not meet Part 71 requirements. Id. at 864-65. Waterford 3 has not made sure that all the fuel in the canisters meets both requirements because the canisters are not licensed for transport. Id. at 864. The Government admitted that "whether or not canistered fuel at Waterford may or may not be transportable when DOE begins [spent nuclear fuel] acceptance from Waterford will be determined by applicable NRC regulations and cask certificates of compliance at the time of transport." PX 1066 at 16. Mr. Maret agreed that DOE did not know whether the canisters would be transportable in the future, and stated that some canisters could be degraded by the time DOE performs. Tr. 2847.

DOE has not identified the dimensions of any cask or how many assemblies a DOE supplied cask could hold. Id. at 2820-21. The Government has admitted that "it would have supplied transportation casks with bolted closures, pursuant to the terms of the Standard Contract, had it begun performance in 1998," but also that it "does not know the specific cask(s) that would have been selected and supplied to Waterford 3" had it begun performance in 1998. Id. at 1125; PX 1066 at 10-11.

General Project Management Costs

Plaintiffs' claim includes dry storage and maintenance costs, including project management costs, associated with Work Order N66105. Pls.' Post-Trial Br. 67. Plaintiffs contend that the costs associated with this Work Order would not have been incurred absent DOE's breach, as Waterford would not have undertaken the dry fuel storage project. Id. at 68. The Government challenges $1,789,227 of Waterford 3's Work Order N66105, which encompassed costs relating to dry fuel storage project management, claiming that "a large portion of the costs charged to this work order included costs related to generic dry fuel storage management of activities recorded to all work orders" in Plaintiffs' claim. Def.'s Post-Trial Br. 44.

Mr. Maret "identified sub-projects within the dry fuel storage effort that [he believed] would have been implemented with timely DOE performances," making these costs unrecoverable. Id. Mr. Maret did not elaborate on how he identified these sub-projects. In order to calculate which portion of the N66105 general project management costs related to the sub-projects Mr. Maret claimed were unallowable, the Government's damages expert, Mr. Robert Peterson, [35] "allocated the generic project management costs recorded to N66105 among all the

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their spent fuel on ISFSIs and dismantled their spent fuel pools, leaving no way to remove the fuel from the canisters and repackage it. DX 177 at 27.

[35] Mr. Robert Peterson was accepted by the Court as an expert in the "quantification of money damages." Tr. 2934. Mr. Peterson is a managing director of LitCon Group, LLC, has a bachelor of science degree in mechanical engineering from Rensselaer Polytechnic Institute and a master of business administration from the University of North Carolina at Chapel Hill. Id. at 2933; DX 185 at 1, App. A at 1. Mr. Peterson "has more than twenty years of engineering and consulting experience" and "has analyzed damages associated with delay, acceleration,

specific activities charged to the work order." Id. He then "calculated the portion of the general management charges" associated with Mr. Maret's sub-projects. Id.

Mr. Maret determined that work order N66105 was for general management costs and attempted to categorize these costs based on the documentation underlying the line items. Tr. 2887-88. Mr. Maret classified any costs with a heading referencing this work order as a general management cost and assigned them to categories if he could. Id. Mr. Maret went through a spreadsheet prepared by Mr. Peterson's employees. Id. at 2885. If he could not assign the line item to a specific category based on the underlying documentation, he applied a proportionate distribution "based on the relative costs compared to the total costs for the individual projects." Id. at 2887-88.

Mr. Maret determined that some costs were supervisory and applied to multiple projects and made a recommendation for how he "thought those uncategorized costs should be distributed." Id. at 2885-86. In practical terms, Mr. Maret made this distribution by populating a column labeled "Technical Review." If Mr. Maret left this column blank, this indicated that the cost was required to load DOE casks or was indeterminate. Id. at 2888; DX 177 at C2-17. Mr. Maret acknowledged that some of the items that he left blank were for welding the Holtec casks closed and other activities that would not have been required to load a bolted DOE cask. Tr. 2890. Mr. Maret did not dispute that this work order contained engineering, supervision, and technical support costs that would be necessary for dry fuel storage. Id. at 2896. Nor did Mr. Maret dispute that the costs for projects that would have been implemented with timely DOE performance were legitimately part of the claim. Id. at 2897. When asked how he decided to employ a standard that all indeterminate items would be categorized as disallowed loading costs, he stated "[t]hat's just the way that the indeterminate items were treated." Id. at 2893-94.

Mr. Peterson used Mr. Maret's work to apportion the amounts that Mr. Maret could not categorize as pertaining to the items charged to this work order. Any line item that Mr. Maret left blank was then questioned by Mr. Peterson and disallowed. When asked what his understanding was as to why Mr. Maret proposed that this subset of the general management costs be disallowed, Mr. Peterson testified: "Well, he's proposing that the management in that work order is managing something, and so what are they managing? They're managing the other activities that are taking place. And so to the extent that he has questioned one of those other activities, there's some management that would go with it, and it's been apportioned." Id. at 3117. He described this apportionment as follows:

> There was a particular work order that had some elements of specific work going on but more of it was related to overall general management of the dry fuel storage work, and we weren't really sure how to initially capture any relationship between the costs recorded there and any of the other adjustments that we were making. So, there were discussions between I'm sure members of my staff and members of Mr. Maret's staff to determine what would be an appropriate methodology.

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disruption, changes in scope of work, productivity losses, and contract termination, among others." DX 185 App. A at 1. Mr. Peterson has "lectured on the topic of identifying and pricing damages" and has testified in several spent nuclear fuel cases. Id. at 2, App. B at 1-6.

> Mr. Maret suggested that these could be reasonably allocated, these being the costs recorded for the management components within work order 66105, could be appropriately allocated out to all the other activities that were not general in nature. So, we concurred that seemed to be a reasonable approach, and so that was the mechanism we went through in our work papers to allocate out the -- again, the amounts that through analysis were determined to be general management in nature within that work order.

Id. at 3019-20. Mr. Peterson further described his apportionment as "attaching management" to activities that Mr. Maret questioned. Id. at 3116. This methodology resulted in Mr. Peterson calculating a percentage per quarter that should be disallowed based on the amount that Mr. Maret identified divided by the net amount of costs in that quarter. Mr. Peterson then reduced the line item costs for each quarter of the damages period by the percentage that he had calculated. Mr. Peterson disallowed 93.8% of the costs questioned by Mr. Maret, yielding a net adjustment for general project management of $1,784,995.

Payroll Loaders

The Government challenges $266,276 in Entergy payroll loaders associated with Resource Codes 19 and 60. At trial, Plaintiffs supported their claim with the testimony of Ms. Stephanie Barras.[36] As Ms. Barras testified, payroll loaders are used to burden internal labor costs and are applied using an automated software system. [37] Id. at 499-501. Ms. Barras' team and other Entergy accountant teams created the loader rates. Id. at 510-11. A resource code designates a type of cost and is used to assign appropriate loaders to transactions. Id. at 503. Entergy has six resource codes for payroll loaders: 2 for incentive compensation, 18 and 19 for benefits, 60 for stock options, 810 for payroll taxes, and 890 for non-productive time. Id. Resource Code 60 was introduced in 2010, as stock options were previously captured under Resource Code 19. Id. at 508-09. Entergy computes and charges these payroll loaders according to generally accepted accounting principles ("GAAP") and Federal Energy Regulatory Commission ("FERC") regulations. Id. at 511.

While Resource Code 18 is associated with "current year costs," such as medical, life, and dental, as well as current year service costs for employee pension and other post-employment benefits, Resource Code 19 is associated with benefits that are not considered "current year service cost based." Id. at 508. Rather, Resource Code 19 includes "things such as gains and losses on the pension trust," "changes in interest costs . . . as well as different amortization and differences in accounting . . . ." Id. at 512. Resource Code 19 includes prior

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[36] Ms. Stephanie Barras is employed by Entergy Services, Inc. as manager of property accounting. Tr. 492. She has a bachelor of science degree in accounting from the University of New Orleans and is a certified public accountant licensed in Louisiana. Id. at 495. Ms. Barras began working for Entergy in 1996 as an entry level accountant and worked her way up to the management level. Id. at 495-96.

[37] Capital suspense is another type of loader that is applied to capital project work, and materials loaders are also used to assign indirect costs of materials to projects. Id. at 517-18, 529. The methodology of computing these two loaders and the payroll loaders are "very similar." Id. at 527.

period costs and non-current benefit costs as well as amortized transition costs due to Entergy's implementation of different accounting standards during the claim period. Id. at 542, 551. Ms. Barras stated that costs attributable to current, past, and retired employees are part of Resource Code 19 and are not specific to any type of employee. Id. at 513.

Ms. Barras explained that Resource Code 19 costs were included in Plaintiffs' claim because

> they are a cost that's incurred by the company and it's an ongoing cost that the company has been paying for years and will continue to pay for years. [. . .] There are costs that are generated today that are part of the loader that may have been attributable – attributed to employees past.

Id. at 513-14. Resource Code 19 costs can be attributed to economic conditions, interest rates, regulations, and other similar things outside of Entergy's control. Id. at 543. Entergy's increases or decreases in contributions to this trust during the period at issue would cause increases or decreases in the Resource Code 19 payroll loader rate in the future. Id. at 544-45. Variables in the trust funding due to interest rates and gains and losses are attributed to Resource Code 19. Id. at 545.

Plaintiffs argue that charges associated with Resource Code 60 are included in their damages claim because "they are indirect costs associated with labor and represent the actual costs of doing business incurred by Entergy." Pls.' Post-Trial Br. 26. Defendant challenged the inclusion of Resource Code 60 within Plaintiffs' claim because "Entergy did not introduce any evidence at trial to establish that the costs allocated through [this] payroll loader[] [was] incurred as a result of DOE's delay in performance." Def.'s Post-Trial Br. 47. With regard to Resource Code 60, Ms. Barras testified that stock options are only available to certain levels of Entergy management and she did not know whether individuals who worked on the dry fuel storage project at Waterford 3 received stock options. Tr. 555-56.

The Government's damages expert, Mr. Peterson, challenged the inclusion of Resource Codes 19 and 60 in Plaintiffs' claim. Mr. Peterson did not challenge any other payroll loaders. Id. at 2996. Mr. Peterson testified that the "biggest issue" with Resource Code 19 was that it included costs from prior periods that became recognized when a change in accounting standards required Entergy to change how it accounted for pension adjustment and post-employment adjustment in its books. Id. at 2999-3001. As this change in standards created a "large, unrecognized expense" for Entergy and other types of companies, they were allowed to amortize this cost over a 20-year window. Id. at 3000. Mr. Peterson did not know when the new accounting standards were implemented, but believed that they were put in place in the late 1980s or early 1990s and "there were a few years grace period and then approximately a 20-year window over which they were amortized." Id. at 3003. Entergy was thus "most certainly" claiming costs allocated to Resource Code 19 that it incurred before the claim period of this suit. Id. at 3003-04.

In Mr. Peterson's view, while this amortized expense was included over the claim period, it was not "tied to or driven by anything associated with the work happening on-site" and would not be repeated. Id. at 3001. Mr. Peterson related a similar concern regarding other costs included in Resource Code 19, as the change in the value of pension plans was not tied to work

at the plant and did not increase or decrease because of any dry fuel storage activities. Id. at 3001-02. With regard to Resource Code 60, Mr. Peterson was concerned because only high-level executives received stock options and this resource code may not have been connected to the dry fuel storage project. Id. at 3002-03. According to Ms. Barras, Resource Code 60 "is a cost that the company incurs in its normal course of business." Id. at 514.

NRC Fees

Plaintiffs' claim includes $1,942,000 in fees assessed by the NRC under 10 C.F.R. Part 171 ("Part 171"). The NRC "has long recovered a substantial portion of its operating budget through fees levied on those that it regulates." PX 1005 at 5. The NRC uses two categories of fees – fees for specific benefits it provides to licensees, which fall under 10 C.F.R. Part 170, and since 1986, annual fees under 10 C.F.R. Part 171 to recover other generic costs. Id. Site-specific fees are license and inspection fees charged directly to the applicant or licensee involved. See 10 C.F.R. § 170.12 (2015). Examples of site-specific fees include fees associated with the review of applications for new licenses, the review of renewal applications, the review of license amendment requests, and inspections of licensees. Id.

In 1991, Congress passed the Omnibus Budget Reconciliation Act ("OBRA-90"), requiring the NRC to recover 100% of its annual budget through fees assessed to license applicants and license holders, less amounts appropriated from the Nuclear Waste Fund. PX 1005 at 5. OBRA-90 also required the NRC to establish a schedule of annual charges that "fairly and equitably" allocated the total annual amount among licensees and had "a reasonable relationship to the cost of providing regulatory services," "to the maximum extent practicable." Id.; 42 U.S.C. § 2214(c)(3) (2012).

Prior to 1999, the NRC recovered its generic costs associated with spent fuel stored outside a spent fuel pool through an annual fee assessed under Part 171, but only on licensees that held a Part 72 license to store spent fuel outside of the spent fuel pool. PX 1005 at 6. The NRC charged a fee for its generic costs associated with spent fuel pools and a separate fee for generic decommissioning activities to all operating Part 50 licensees, but not on Part 50 possession-only licensees that decided to forgo dry fuel storage in favor of wet storage. Id.; Tr. 1451. Thus, all operating licensees paid to cover the NRC's generic fees associated with regulating spent fuel pools, but only licensees that had Part 72 dry storage paid a fee to cover the NRC's generic costs associated with this dry storage.

However, in 1999, the NRC established a new fee under Part 171, the Spent Fuel Storage/Reactor Decommissioning Fee ("SFS/RD fee").[38] PX 1005 at 7. In the proposed rulemaking, the NRC observed that the existing policy raised the following concerns about the equitable allocation of generic fees:

> (a) [t]he fee structure could create a disincentive for licensees to pursue dry storage; (b) [t]he fairness of assessing multiple annual fees if a licensee holds multiple [dry storage] licenses for different designs; and (c) [n]ot all affected

[38] NRC rules are issued by a five-person Commission, including the NRC Chairman. 42 U.S.C. § 5841(a) (2012). The Commission members are appointed by the President and confirmed by the United States Senate. Id. at § 5841(b).

> licensees are being assessed the costs of NRC's generic decommissioning activities.

Revision of Fee Schedules; 100% Fee Recovery, FY 1999, 64 Fed. Reg. 15,876, 15,881 (Apr. 1, 1999).

During the notice-and-comment rulemaking process, one commenter observed that a fee change would be unnecessary had the DOE honored its obligations under the Standard Contract. The NRC responded in the Final Rule:

> The NRC recognizes that sites will be required to continue to store spent fuel onsite until another solution becomes available. The fact that DOE has not taken possession of the spent fuel does not relieve NRC of the OBRA-90 [Omnibus Budget Reconciliation Act of 1990] requirement to recover approximately 100 percent of its budget authority through fees, including those costs associated with generic spent fuel storage activities . . . . The current policy has raised concerns that the fee structure could create a disincentive for licensees to pursue dry storage. The spent fuel storage/reactor decommissioning annual fee will give equivalent fee treatment to both storage options [wet storage and dry storage].

Revision of Fee Schedules; 100% Fee Recovery, FY 1999, 64 Fed. Reg. 31,448, 31,455 (June 10, 1995). The NRC assessed a fee on all Part 50 licensees and on licensees with Part 72 storage licenses but without Part 50 licenses, a Spent Fuel Storage/Reactor Decommissioning Fee, which levied a generic fee on all licensees, regardless of whether they used wet or dry storage.

Plaintiffs proffered Mr. Jesse L. Funches to provide an expert opinion to support their claim for these fees. Mr. Funches joined the NRC in 1978, as an advisor to Commissioner John Ahearne and continued this role when Mr. Ahearne was appointed Chairman, providing advice on budgetary and other financial and administrative matters. PX 1005 at 3. Mr. Funches then served as the Director of Planning and Program Analysis Staff in the NRC's Office of Nuclear Reactor Regulation from 1981 to 1987, and in the NRC's Office of Nuclear Materials and Safeguards from 1987-90. Id. at 4. In both roles, Mr. Funches managed a staff of approximately 30 and "defined the programs, program elements, and planned accomplishments for the NRC's annual budgets." Id.; Tr. 1143. From 1990 to 1997, Mr. Funches held the position of Deputy Controller of the NRC. Mr. Funches "was assigned the lead responsibility for developing the first 10 CFR Part 170 and 10 CFR Part 171 fee rules" to implement the new OBRA-90 requirements. PX 1005 at 4. He also participated in the development and justification of the NRC's annual budget. Id.

In 1997, Mr. Funches was appointed Chief Financial Officer ("CFO") of the NRC and reported directly to the NRC Chairman. Tr. 1145. He held this position until his retirement in 2007. PX 1005 at 4. In October 1998, in response to the Commission's request, Mr. Funches' staff provided a Spent Fuel Storage and Decommissioning Fee Study. Id. at 7. Mr. Funches reviewed and approved this study, but did not author it and was not a member of the study team. Tr. 1409. Based on the October 1998 study, Mr. Funches recommended the establishment of the Spent Fuel Storage/Reactor Decommissioning Fee. PX 1005 at 7. In his role as CFO, Mr. Funches met each morning with the NRC's Chairman and other senior managers, and typically

met with the other Commissioners about once a month, and would brief the Commission "maybe once or twice a year." Tr. 1147.

Mr. Funches was admitted as an expert in NRC annual fee assessment, including the Spent Fuel Storage/Reactor Decommissioning Fee ("SFS/RD fee") adopted in 1999. Id. at 1178-79. Mr. Funches opined that,

> [i]n establishing the SFS/RD Fee, the NRC concluded . . . that beginning in FY1999, the NRC's costs associated with generic spent fuel storage activities should be included in the cost of providing services to all power reactors. The underpinning for this finding was the fact that DOE was not accepting spent fuel from utilities beginning in 1998 as provided in the Standard Contract, and therefore the NRC's generic activities for reactor spent fuel pool storage and dry spent fuel storage would benefit all power reactors, the majority of which would eventually require additional storage due to DOE's breach. If DOE had not breached the Standard Contract, and DOE would have begun accepting the spent fuel in 1998, the number of Part 50 licensees that required storage beyond their existing spent fuel pool would have been minimized. In that circumstance, the NRC would not have assessed the SFS portion of the SFS/RD Fee on the power reactor class of licensees . . . because those activities would have benefited only the much smaller class of licensees that would have required additional storage outside of their existing spent fuel pools.

PX 1005 at 7-8. Mr. Funches indicated that the NRC would not have been complying with OBRA-90 if it had changed the fee structure in the non-breach world, because most reactors would not have needed dry fuel storage had DOE picked up the spent nuclear fuel. Tr. 1436.

In providing this opinion, Mr. Funches relied on several documents:

- Excerpts of the March 1995 Congressional testimony of former NRC Chairman Ivan Selin concerning the assessment of annual fees. PX 998;

- A February 2, 1998 memorandum from NRC Secretary John Hoyle to NRC Chairman Shirley Jackson and NRC Commissioner Edward McGaffigan, Jr. ("Feb 1998 Memorandum"), on which Mr. Funches was copied. JX 9;

- Mr. Funches' February 27, 1998 "Policy Issue" memorandum to the NRC Commissioners ("Sec'y 98-034"), which requests that the Commissioners consider whether to use rebaselining or a percent change as the methodology for calculating fiscal year 1998 annual fees. JX 10;

- A March 9, 1998 Staff Requirements Memorandum ("SRM")[39] from NRC Secretary Mr. Hoyle to Mr. Funches and Executive Director for Operations, L. Joseph Callan (COMSAJ-98-001). DX 218;

[39] A SRM reflects a Commission decision that requests the NRC staff to perform a specified task. Tr. 1292.

- Mr. Funches' November 5, 1998 "Policy Issue" memorandum to the NRC Commissioners ("Sec'y 98-260"), which included the October 1998 Spent Fuel Storage and Decommissioning Study. DX 224;

- Commissioner Merrifield's December 4, 1998 Comments on Sec'y 98-260 (FY 1999 Fee Rulemaking). JX 12;

- Commissioner McGaffigan's December 14, 1998 Comments on Sec'y 98-260 (FY 1999 Fee Rulemaking). JX 13;

- A February 2, 1999 SRM – drafted in response to Sec'y 98-260 – from NRC Secretary Annette Vietti-Cook to Mr. Funches and General Counsel Karen Cyr, with all five Commissioners copied on the memorandum. JX 14;

- The 10 C.F.R. Parts 170 and 171 June 1999 final fee rule, containing a comment from a nuclear utility about the SFS/RD fee and the NRC's response. DX 61.

Mr. Funches acknowledged that the NRC is composed of four Commissioners and a Chairman, and that he had never served in any of these roles. Tr. 1333. He further acknowledged that the 1999 fee rule change was a policy decision that required the approval of the Commissioners. Id. at 1335-36. While Mr. Funches had the responsibility to respond to questions in his role as CFO, he was never delegated authority to be a spokesperson for the Commission. Id. at 1338-39. Mr. Funches did not recall any specific conversations he had with the Commissioners in which they told him that the reason for the reassessment of Part 171 was DOE's delay in performance under the Standard Contract. Id. at 1172. He also did not remember any specific oral statement by any of the Commissioners to the effect that they were approving the SFS/RD fee because of DOE's breach of the Standard Contract. Id. at 1174.

Mr. Metcalfe offered an opinion on the "economic implications, if any, of NRC's adoption of a revised methodology for charging utilities like Waterford Part 171 fees in 1999." Id. at 1842-43. Mr. Metcalfe opined that "[h]ad DOE performed in accordance with its contractual obligation, the NRC would not have had to change its fee structure in 1999." PX 116 at 27. Mr. Metcalfe relied on the 10 C.F.R. Parts 170 and 171 June 1999 final fee rule, containing a comment from a nuclear utility about the SFS/RD fee and the NRC's response, Sec'y-98-260, the October 1998 Spent Fuel Storage and Decommissioning Fee Study, Commissioner Merrifield's and Commissioner McGaffigan's December 1998 comments, and the February 2, 1999 SRM from NRC Secretary Annette Vietti-Cook to Mr. Funches and General Counsel Karen Cyr, with the five Commissioners copied. PDX 7 at 62-71.

For each year between 1999 and 2012, Mr. Funches created a breakdown, in the form of percentages, of the portion of the SFS/RD fee he determined was allocated to NRC generic activities in the categories of dry spent fuel storage, reactor spent fuel storage, and reactor decommissioning. PX 1005 at 9-15. Mr. Metcalfe then used these percentages to calculate Waterford 3's alleged damages, using the percentage of the SFS/RD fee for each year that Mr. Funches had determined was used for dry spent fuel storage generic activities. Tr. 1857-58.

Allegedly Unsupported Transactions

Defendant challenges $1,488,727 of Plaintiffs' claimed damages on the grounds that they are "unsupported by adequate contemporaneous documentation . . . ." Joint Stip. ¶ 2. Mr. Peterson separated these charges into three categories –

1. Transactions missing documentation,
2. Transactions missing capital suspense rate information, and
3. Invoices for which Plaintiffs did not provide discovery responses.

DDX 6 at 5-6.[40]

Both Mr. Metcalfe and Mr. Peterson testified about the invoices encompassing the first and third categories. The first category consists of allegedly incomplete invoices and missing accounting system transactions. Id. at 5. Mr. Metcalfe did not agree that any of the transactions in the first category were unsupported and determined, after reviewing the documents and supporting material and discussing them with plant staff, that all of the challenged invoices had been paid and were properly included in the claim. Tr. 1912-45. Mr. Metcalfe also testified that all of the charges in the third category were properly included in the claim and paid. Id. at 1959-67.

However, Mr. Peterson testified that he had not challenged any invoice on the basis of whether or not it was paid. Rather, Mr. Peterson's exclusions resulted from other information he believed was lacking. Id. at 2944-45. Mr. Peterson testified as to what documents he determined were missing for the first category of invoices. Id. at 2958-75; DDX 6 at 7-14. For example, Mr. Peterson noted that certain invoices referred to other documents, such as attached letters, that had never been provided. DDX 6 at 10. Mr. Peterson also testified that he was not able to tie all invoices to Entergy's accounting data and that certain transactions had been assigned a resource code that Mr. Metcalfe had previously determined should not be part of Plaintiffs' damages. Tr. 2982-83. In regard to the third category of challenged damages, Mr. Peterson described how Mr. Maret's company had requested "information on a wide variety of different work orders and individual invoices" from Plaintiffs. Id. at 2988-90. After receiving discovery responses, Mr. Maret and his staff could not "understand the connection to the particular overall work order to which it was charged or they had a document that did not provide sufficient description of the work" for four particular invoices, so Mr. Peterson disallowed these damages. Id. at 2992.

As to the second category of challenged damages, Plaintiffs and Defendant agree that documentation of the actual percentage rate that Entergy used as a capital suspense loader was not available for the time period of 1996 through June 1998. Id. at 1955, 2985; DDX 6 at 16. Mr. Peterson challenged capital suspense costs for the first half of 1998 because he could not determine that the rate was properly applied. Tr. 2987-88. Before this time, the rate was apparently 0%. Id. at 2988.

[40] The total amount of allegedly unsupported transactions consists of $1,039,261 in transactions missing documentation, $164,267 in transactions missing capital suspense rate information, and $285,198 in transactions with missing discovery responses. DDX 6 at 6.

Discussion

Damages for Partial Breach of Contract

The remedy for breach of contract is an award of "damages sufficient to place the injured party in as good a position as it would have been had the breaching party fully performed." Indiana Michigan Power Co., 422 F.3d at 1373. Mitigation damages are intended to reimburse a non-breaching party to a contract for the expenses it incurred in attempting to rectify the injury caused by the breach. In particular, mitigation damages are available to compensate plaintiffs for "efforts to avoid damages in contemplation of a partial breach." Id. at 1375 ("Mitigation is appropriate where a reasonable person, in light of the known facts and circumstances, would have taken steps to avoid damage."); see generally Restatement (Second) of Contracts § 347 cmt. c (Am. Law Inst. 1981) ("[T]he injured party is entitled to recover for all loss actually suffered . . . includ[ing] costs incurred in a reasonable effort, whether successful or not, to avoid loss."). Damages should not place the non-breaching party "in a better position . . . than if there had been no breach." Bluebonnet Sav. Bank, FSB v. United States, 339 F.3d 1341, 1345 (Fed. Cir. 2003) (per curiam) ("Bluebonnet II"); see also San Carlos Irrigation & Drainage Dist. v. United States, 111 F.3d 1557, 1563 (Fed. Cir. 1997). Damages for a breach of contract are recoverable if they were reasonably foreseeable, were substantially caused by the breach, and are shown with reasonable certainty. Indiana Michigan Power Co., 422 F.3d at 1373.

Plaintiffs may recover damages for partial breach of the Standard Contract if they can show that "but for the breach, the alleged damages would not have been suffered." San Carlos Irrigation & Drainage Dist., 111 F.3d at 1563. The Federal Circuit has expressed a preference for the traditional "but-for" test in spent nuclear fuel cases. See Yankee Atomic, 536 F.3d at 1272-73. Although a plaintiff must show that the claimed losses "would not have occurred but for the breach," the breach need not be the sole cause of the incurred damages. Cal. Fed. Bank v. United States, 395 F.3d 1263, 1268 (Fed. Cir. 2005); Anchor Sav. Bank, FSB v. United States, 81 Fed. Cl. 1, 60 (2008).

Plaintiffs must present a "comparison between the breach and non-breach worlds." Yankee Atomic, 536 F.3d at 1273. The plaintiff bears the burden of proving "the extent to which his incurred costs differ from the costs he would have incurred in the non-breach world." Energy Northwest III, 641 F.3d at 1306. Therefore, "a plaintiff seeking damages must submit a hypothetical model establishing what its costs would have been in the absence of breach." Id. at 1305 (citing Glendale Fed. Bank, FSB v. United States, 239 F.3d 1374, 1380 (Fed. Cir. 2001) ("Glendale I")). "It is only by comparing this hypothetical 'but-for' scenario with the parties' actual conduct that a court can determine what costs were actually caused by the breach, as opposed to costs that would have been incurred anyway." Id. (citing Glendale I, 239 F.3d at 1380); see also Yankee Atomic, 536 F.3d at 1273.

To show damages with reasonable certainty "it is not essential that the amount [of damages] be ascertainable with absolute exactness or mathematical precision: 'It is enough if the evidence adduced is sufficient to enable a court or jury to make a fair and reasonable approximation.'" Bluebonnet Sav. Bank, FSB v. United States, 266 F.3d 1348, 1355 (Fed. Cir. 2001) ("Bluebonnet I") (quoting Elec. & Missile Facilities, Inc. v. United States, 189 Ct. Cl. 237 (1969)). A recovery for speculative damages is precluded. Indiana Michigan Power Co., 422

F.3d at 1373; see also Glendale Fed. Bank, FSB v. United States, 378 F.3d 1308, 1313 (Fed. Cir. 2004) ("Glendale II").

"[T]the defendant may eliminate or reduce the alleged damages by showing either that the '[p]laintiffs did not undertake reasonable mitigation efforts, or that the efforts they did undertake were unreasonable.'" Entergy Nuclear Vt. Yankee, LLC v. United States, 95 Fed. Cl. 160, 184 (2010), aff'd in part, rev'd in part on other grounds sub nom. Vt. Yankee Nuclear Power Co. v. Entergy Nuclear Vt. Yankee, LLC, 683 F.3d 1330 (Fed. Cir. 2012) (citing Carolina Power & Light Co. v. United States, 82 Fed. Cl. 23, 44 (2008)) (alteration in original).

Reracking Costs

Plaintiffs claim $8,490,310 in mitigation damages for the spent fuel pool rerack, exclusive of the associated payroll loaders for Resource Codes 19 and 60 and allegedly unsupported transactions. Plaintiffs began planning for the rerack in 1995-96, and the rerack was accomplished in November 1998, and prevented loss of full core reserve in 2000. Plaintiffs argue that Defendant's breach caused them to rerack because in the non-breach world, they would have avoided infringing on full core reserve in 2000, by using allocations from Pilgrim and Indian Point 3 from 2000 until 2006, when DOE would have picked up fuel from Waterford 3. The Court rejects this argument, finding that the breach was not the but-for cause or even a substantial factor in Entergy's decision to rerack. Although Entergy knew that DOE would not likely perform as early as 1993, DOE was not scheduled to pick up spent nuclear fuel from Waterford 3 until 2006. Entergy had a much more pressing need to rerack well in advance of 2006, due to its loss of full core reserve in 2000.

Consistent with their philosophy and conduct in the actual world, the Waterford 3 employees would have been prudent planners, who would have started considering whether a rerack was necessary five years in advance of losing full core reserve. Waterford 3 would have needed to produce Strategic and Tactical Plans for overall management of the front and back end of the fuel cycle, even with DOE performance. The Court finds that in the 1995-96 timeframe, Entergy would have analyzed how to deal with spent fuel at Waterford 3, in exactly the same way in the non-breach world as it did in the breach world – the plant management would have determined that reracking was the most economical and beneficial solution, as opposed to shipping fuel to DOE, using dry fuel storage at another Entergy plant or at an Indian reservation, or constructing a dry fuel storage facility at Waterford. JX 6 at 7844.

The record reflects that a key concept used in making fuel storage decisions at Waterford was maintaining full core reserve or full core discharge capability. This "important planning concept" meant maintaining enough space in the spent fuel pool to discharge all the fuel assemblies from the reactor core – 217 assemblies at Waterford. Tr. 100. The purpose of maintaining full core reserve was to ensure that all of the fuel could be removed from the reactor to allow for inspection or maintenance. Id. at 101. Waterford attempted to have full core reserve "at all times." Id. at 100. Waterford occasionally infringed on full core reserve, but the plant would work hard to avoid this state. Id. 101-02, 194. Maintaining full core reserve was not a regulatory or an operating requirement, but "a target" and "prudent planning" because there might be times when the reactor had to be completely emptied of fuel. Id. at 102-03. Without being able to perform unscheduled repairs or inspections, the plant could not be restarted, which would cost between $500,000 to $1 million a day in replacement power costs. Id. at 103-04.

Additionally, if there were no room in the spent fuel pool to unload old fuel from the reactor, the reactor could not be refueled and would be unable to operate. Id. at 105-06.

Given this key concept, the plant managers would not have wanted to lose full core reserve in the non-breach world. In the mid-1990s, the plant managers recognized that after 2000, two additional fuel cycles could occur without full discharge capability, but the plant would have to shut down in 2004, because it would run out of space in the spent fuel pool. Id. at 465. As seen in a September 1996 chart, Waterford 3 had projected its discharges and space in the spent fuel pool until the end of the reactor's license in 2024. JX 30 at 0318. The plant could thus predict that when cycle 10 ended in July 2000, there would be 892 assemblies in the spent fuel pool, impinging on full core reserve. Id. By the end of 2004, the total number of assemblies would be over the 1,088 space upper limit. At the end of cycle 11 in April 2002, there would be 992 assemblies in the pool and by the end of cycle 12 in April 2004, 116 assemblies would need to be discharged, taking up the remaining space in the pool and preventing the plant from continuing operations. Id.

The Court finds that this rerack would have been implemented as soon as practicable to avoid the loss of full core reserve in 2000, even in the non-breach world. In the breach world, the plant managers started to consider the rerack project in 1993, and began to plan it in earnest in 1995-96. In January 1996, the plant decided to take bids on reracking, eliminating other options such as dry fuel storage, both on site and in other locations, and transporting spent fuel directly to DOE. JX 6 at 7845. In May 1996, the plant put out a request for bids for the rerack project and reviewed those bids in September 1996. JX 30 at 0315, 0321. Waterford 3 signed a contract with Holtec in 1996 and anticipated the rerack work being completed in July 1998 based on the schedule put forth by Holtec. Tr. 2518. In the breach world, the plant managers were aware that an NRC license amendment would be needed and would take one year to be approved. JX 30 at 0321. They also anticipated that a rerack would take two years to be completed. Id. at 0320. Entergy submitted its license amendment in March 1997, and requested that it be approved by January 1998, to support a rerack completion date of July 1998. JX 8 at 1. However, it was not approved until July 10, 1998, and Entergy's management approved the design change package for the rerack to allow changes to be made to the Waterford 3 plant on July 23, 1998. Tr. 459, 2536; PX 1036 at 2540. This design change package stated that the rerack needed to occur before the end of fuel cycle 9, scheduled for October/November 1998, because otherwise there would be too many assemblies in the pool to permit reracking to be done using divers - - a significant cost benefit over using a remotely operated tool. PX 1036 at 2553-54; Tr. 2519. The installation of the new Holtec racks was completed in November 1998. Thus, the rerack project from initial planning until completion, spanned two years and eleven months, from December 1995 until November 1998.

Additionally, reracking would have helped the plant to deal with its boroflex degradation issue. While not the sole reason for the rerack, removing the boroflex would have been a useful benefit that would have militated in favor of reracking, as it did in the breach world. Therefore, given the known constraints that would still have been applicable in the non-breach world – the 2000 full core reserve loss, the 2006 DOE pickup date, the boroflex issue, and the awareness that a rerack needed to be started well ahead of time – the Court finds that the rerack would have occurred in the non-breach world and was not caused by the Government's partial breach.

Plaintiffs creatively attempt to eliminate the fact of Waterford 3's 2000 loss of full core reserve by arguing that they would have avoided infringing on full core reserve by using allocations from Pilgrim and Indian Point 3 from 2000 until the DOE pick up in 2006. Plaintiffs' exchange allocation construct is squarely defeated by the chronology here. In 1995-96, Waterford had to plan how to deal with its upcoming loss of full core reserve as of 2000, whether via rerack or another strategy. At that time, the Pilgrim and Indian Point 3 acquisitions were not yet on the horizon. Therefore, Mr. Metcalfe testified that Waterford would have considered obtaining allocation rights from ANO as a temporary placeholder in his hypothetical non-breach world. Tr. 1196-97. The Court, however, struck Mr. Metcalfe's testimony that Plaintiffs would have relied upon ANO's allocations as being a surprise, and also noted that it was bereft of the detail that would have made this aspect of Mr. Metcalfe's but-for world plausible - - what plans Waterford and ANO would have made, what ANO's plans for a rerack or ISFSI were, what the costs would have been, and why projecting to use ANO's allocations was a plausible choice given Waterford's other options.

Even considering Mr. Metcalfe's testimony on using ANO's allocations, the Court does not credit Mr. Metcalfe's opinion that Waterford 3 could have avoided the rerack by using allocations from Pilgrim and Indian Point 3 starting in 2000. To prove causation, it is incumbent upon plaintiffs to establish a plausible but-for world. See Yankee Atomic, 536 F.3d at 1273 (citing Bluebonnet Sav. Bank FSB v. United States, 67 Fed. Cl. 231, 238 (2005)). Simply put, Waterford 3 decision-makers would not have been aware that Entergy would later own these plants when Waterford 3 would have been making its reracking decision in 1995-96. Any reliance on these allocations is thus not plausible. The sale of Pilgrim, the plant needed for allocations in 2000, was competitively bid and hence Entergy could not have counted on owning the plant ahead of the sale. Tr. 166. Even if some "due diligence" might have occurred prior to July 1999, when Entergy acquired Pilgrim, Waterford 3 could not have reasonably planned to use those allocations. Under the Standard Contract, the necessary forms for exchanges had to be submitted to DOE not less than six months prior to the delivery date, to use Pilgrim's allocations until Entergy actually owned Pilgrim.

Although DOE would be performing in the non-breach world, the spent fuel would have been collecting inside the spent fuel pool prior to DOE's first scheduled pick up at Waterford 3 in 2006. The Court does not find it plausible, as Plaintiffs suggest, that Waterford 3 would have taken a "wait and see" approach, doing nothing but hoping to obtain some allocations from other Entergy plants or other utilities before losing full core reserve in 2000, or waiting beyond 2000 to make a decision. Pls.' Post-Trial Reply Br. 13.

The Court Denies Plaintiffs' Cask Loading Costs

Plaintiffs claim $3,966,282 in costs incurred to load spent nuclear fuel into dry storage casks at Waterford 3. Defendant asserts that Plaintiffs cannot recover these costs because they would have paid these costs in the non-breach world and because they have not proven how the non-breach world loading costs would differ from the breach world costs. Def.'s Post-Trial Br. 35-42. In response, Plaintiffs contend that Defendant seeks an "offset" to Plaintiffs' damages under an "avoided cost" theory. However, the Government emphasizes that it is not arguing that Plaintiffs avoided the cask loading costs due to DOE's breach and hence is not seeking an offset, for which it must shoulder the burden of proof. Id. at 41.

Plaintiffs rely on Carolina Power & Light Co. v. United States, 573 F.3d 1271 (Fed. Cir. 2009) ("Carolina Power"). In that case, the Government argued that Plaintiffs' claim should be reduced by cask loading costs that they had avoided due to the Government's breach. Carolina Power, 573 F.3d at 1277. However, the Federal Circuit disagreed and held that the Government was not entitled to offset Plaintiffs' damages with cask loading costs because Plaintiffs had not actually avoided these costs due to the Government's breach. Rather, the Court found that Plaintiffs will not incur these costs until DOE picks up the spent nuclear fuel. Id. The Federal Circuit rejected the Government's "avoided cost" theory because "'[j]ust as the utilities cannot now collect damages not yet incurred under the ongoing contract, the [G]overnment cannot prematurely claim a payment that has not become due.'" Id. (quoting Yankee Atomic, 536 F.3d at 1281).

As the Federal Circuit explained in Energy Northwest III:

> Carolina Power addresses the separate circumstance where a breaching party seeks to offset an award by proving that the non-breaching party has achieved some cost savings because the breach permitted it to avoid—not just defer—some aspect of performance. Carolina Power properly urges caution when speculating about the future in a case of partial breach—usually, the proper approach is to wait for those events to actually occur, and to resist premature conclusions.

641 F.3d at 1306-07 (citing Carolina Power, 573 F.3d at 1277). The Government was not seeking an offset for avoided costs in Energy Northwest III, but instead argued that the plaintiff had not proven that certain site modification costs differed from those in the non-breach world. The Federal Circuit found that the plaintiff was entitled to recover the cost of those modifications only to the extent that it could prove "to a reasonable certainty, that but for the [G]overnment's breach they would not have been incurred." Id. at 1305-07.

Plaintiffs attempt to distinguish Energy Northwest III on the basis that it discussed plant modifications instead of cask loading costs. Pls.' Post-Trial Br. 50-51. However, Plaintiffs do not point to any case exempting cask loading costs from the Federal Circuit's well established requirement that a utility present a "comparison between the breach and non-breach worlds." Yankee Atomic, 536 F.3d at 1273. Here, as in a subsequent Energy Northwest case, "the Court has no principled basis (nor have plaintiffs offered one) for treating 'cask loading' differently from the 'plant modification costs' at issue in [Energy Northwest III] . . . ." Energy Nw. v. United States, 115 Fed. Cl. 69, 76 (2014); see also Ala. Power Co. v. United States, 119 Fed. Cl. 615, 629 (2014) (holding that because plaintiffs failed to prove that their incurred fuel characterization and loading costs would not have been incurred in the non-breach world, plaintiffs were not entitled to recovery for these costs); Sys. Fuels, Inc. v. United States, 120 Fed. Cl. 635, 660-62 (2015) ("Grand Gulf II") (denying plaintiffs' cask loading costs because plaintiffs failed to establish the costs of using DOE casks and acknowledged that these costs would have been incurred even with DOE performance).

Similarly, in the instant case, the Government is not seeking an offset, it is claiming that Plaintiffs failed to their meet their burden of proving what their cask loading costs would have been in the non-breach world. As with their other claimed damages, Plaintiffs must prove the extent to which their incurred costs differ from the costs they would have incurred in the non-breach world. See Energy Northwest III, 641 F.3d at 1306. Plaintiffs here have proffered no

evidence, however, as to how their incurred costs differ from the cask loading costs they would have incurred in the non-breach world.

Plaintiffs' technical expert, Ms. Supko, did not identify any cask loading costs that would have been incurred had DOE picked up the spent nuclear fuel as scheduled. As Ms. Supko stated in her expert report:

> At counsel's direction, I have not attempted to assess any costs that may have been incurred by Entergy to load DOE transportation casks in the non-breach world. I further understand from counsel that consideration of such non-breach world loading costs has been foreclosed as a matter of law by the U.S. Court of Appeals for the Federal Circuit in Carolina Power & Light Co. v. United States, 573 F.3d 1271 (Fed. Cir. 2009).

PX 1 at 1. Although Ms. Supko identified several plausible DOE transportation casks that allegedly could have been used at Waterford 3, and presented a detailed scenario of how such casks could have been loaded, she did not perform any analysis of the costs to load any of these plausible DOE transportation casks. Id. at 29-30; Tr. 1622.

Plaintiffs argue that any failure to construct a model of the non-breach world was caused by the Government's failure to provide useful information in discovery about the type of cask that DOE would have used. The Court, however, does not find that DOE obstructed Plaintiffs' discovery efforts. As Ms. Supko noted in her expert report, DOE at first planned in the 1980s to develop its own fleet of transportation casks, but stopped obligating funds to this development program in 1993, without ever submitting a cask to the NRC for certification. PX 1 at 19. Even without additional information about a cask that DOE would have used in the non-breach world, Ms. Supko was able to describe, in detail, several plausible casks that could have been used at Waterford 3, including their height, weight, and capacity. Id. at 21-22. Ms. Supko was also able to model a loading sequence, including what equipment she believed would have been used in the non-breach world. Ms. Supko did not identify any missing information that prevented her from considering loading costs in her non-breach scenario, but elected not to include them based solely on counsel's instruction.

The Federal Circuit rejected a similar argument that the Government prevented the plaintiff from establishing costs in the non-breach world in Energy Northwest III, stating:

> it is worth considering whether the [G]overnment somehow constrained Energy Northwest from carrying its burden under Yankee Atomic. On the record before us we do not see any evidence that the [G]overnment somehow obstructed Energy Northwest from presenting, on the available evidence, its best possible model of what the DOE would have done absent breach. The discovery process affords litigants the opportunity to learn even confidential details of what each other knew, or planned, or what was technically possible, at various points in time. The opinions of experts can be leveraged to fill gaps. Should one party unjustifiably fail to participate in discovery, trial courts have a variety of remedial measures available, up to and including the resolution of fact issues against the non-participating party. On the record before us we are unable to say that Energy Northwest faced any improper hindrance in its ability to assemble the proof

> required by Yankee Atomic. We therefore see no reason why the burden of proving the non-breach world—as to the plant modifications—should not lie with Energy Northwest.

641 F.3d at 1307-08 (footnote omitted). Here, the Court finds that Plaintiffs could have filled any gaps in the hypothetical non-breach world loading costs through expert testimony and were not hindered from doing so by the Government.

Plaintiffs were required to cover cask loading costs under the Standard Contract, but they have not provided a cost assessment of how their actual performance differed from what they would have done under the Standard Contract in the non-breach world. See JX 1, Art. IV.A.2(a) ("The Purchaser shall arrange for, and provide, all preparation, packaging, required inspections, and loading activities necessary for the transportation of [spent nuclear fuel] . . . to the DOE facility."). Rather, Plaintiffs merely argue that loading Holtec containers "is a much more involved and difficult process than Plaintiffs would have had to engage in if DOE had brought bolted transportation casks to the Waterford site" and that the costs to "load welded Holtec storage casks are starkly different from the costs that Plaintiffs would likely have incurred to load bolted DOE-supplied transportation casks." Pls.' Post-Trial Reply Br. 26-27. Other than making these general assertions, Plaintiffs have not provided any proof as to how their cask loading costs would have differed between the breach and non-breach world. Plaintiffs are required to prove, with a reasonable certainty, how the costs they have actually incurred as a result of DOE's breach are different than those they would have incurred in the non-breach world. While mathematical precision is not required, the Court cannot begin to determine, on this record, what cask loading costs Plaintiffs would have incurred in the non-breach world, and how these costs differed from the actual costs of the Holtec loading process. See Bluebonnet I, 266 F.3d at 1355; Indiana Michigan Power Co., 422 F.3d at 1373.

Finally, Plaintiffs argue that if they are not awarded cask loading costs, they will be forced to pay for cask loading twice, as they will have to load DOE casks in the future when DOE performs. Pls.' Post-Trial Br. 54-55. None of Plaintiffs' canistered fuel is acceptable for pickup by DOE without an amendment to the Standard Contract, and neither party knows what the terms of any amendment to the Standard Contract might be. While Plaintiffs may incur additional damages in the future due to the Government's failure to perform, that potential does not entitle them to damages now. See Yankee Atomic, 536 F.3d at 1281-82; see also Indiana Michigan Power Co., 422 F.3d at 1376-78 (holding that in a partial breach case, the plaintiff cannot recover prospective damages for anticipated future non-performance).

For the above reasons, the Court denies Plaintiffs' claimed $3,966,282 in cask loading costs.

The Court Does Not Award Plaintiffs Crane Upgrade Costs

Plaintiffs claim $8,505,653 for the fuel handling building crane upgrade and related replacement of the crane control system and motors. Joint Stip. ¶ 6(b); Tr. 686-90. Plaintiffs' claim includes an offset of $660,338 to repair gates in the fuel handling building. Pls.' Post-Trial Brief 19; PX 116 at 22 n.42. This offset was included because Ms. Supko's model depends on Plaintiffs repairing the gates in the fuel handling building to make them removable. The parties

dispute whether Plaintiffs have presented sufficient evidence to prove that the crane upgrade would not have been necessary in the non-breach world.

In order to establish causation, Plaintiffs must establish a plausible but-for world. See Yankee Atomic, 536 F.3d at 1273 (citing Bluebonnet Sav. Bank, 67 Fed. Cl. at 238). The Federal Circuit has not specifically defined the meaning of "plausible" in the context of establishing a but-for world. As the trial court in Kansas Gas recognized, "'[p]lausible' is a nondescript qualifier and 'plausibility,' a nebulous standard." See Kan. Gas & Elec. Co. v. United States, 95 Fed. Cl. 257, 275 (2010), aff'd in part, rev'd in part on other grounds by Kan. Gas & Elec. Co. v. United States, 685 F.3d 1361 (Fed. Cir. 2012) (finding that plaintiff was required to provide evidence of its performance in the non-breach world that would establish the attainability of the "but-for" model). The United States Supreme Court has explained the concept of plausibility in the context of motions to dismiss for failure to state a claim upon which relief can be granted. As stated by the Supreme Court, a "plausible" claim is one that contains "factual content that allows the court to draw the reasonable inference that the defendant is liable for the misconduct alleged." See Bell Atl. Corp. v. Twombly, 550 U.S. 544, 570 (2007); Ashcroft v. Iqbal, 556 U.S. 662, 678 (2009). The plausibility requirement demands more "than a sheer possibility that a defendant has acted unlawfully." Iqbal, 556 U.S. at 678. Importing this standard here would require Plaintiffs to establish a model that is more than merely possible or conceivable had Defendant performed. Twombly, 550 U.S. at 570. Based upon the record as a whole, the Court concludes that Ms. Supko's model of the hypothetical non-breach world with respect to the crane upgrade is not plausible.

Ms. Supko concluded that "had DOE begun performance in 1998 . . . , Entergy could have, and plausibly would have, selected truck shipment for acceptance of [spent nuclear fuel] from the Waterford site." PX 1 at 9. Ms. Supko noted that the Waterford 3 cask drop analysis was performed assuming a 23.5 ton (47,000 pound) FSV-1 cask dropped from a height of 43.25 feet. Id. at 24. Ms. Supko concluded that this cask drop analysis would cover the use of an approximately 30-ton DOE cask, such that another cask drop analysis would not have been needed. Id. Additionally, a Part 71 transportation cask, such as the DOE cask, would necessarily have been designed to withstand a 30-foot drop on to an unyielding surface. Id. Ms. Supko therefore determined that Waterford 3 could handle a DOE transportation cask with a maximum diameter of 11 feet, 1 inch, and a maximum length of approximately 18 feet. Id. at 10. The DOE casks described by Ms. Supko weigh between 23 and 27.1 tons, have lengths between 188 and 208 inches (without impact limiters),[41] diameters between 28 and 48.31 inches, and can hold one to four spent nuclear fuel assemblies. Id. at 22.

Ms. Supko modeled how Waterford 3 would have loaded a DOE-supplied cask in the non-breach world. The DOE cask would have arrived via a DOE transport vehicle at the fuel handling building rail bay. Id. at 25. The DOE cask would have been brought into the fuel handling building through Gate 4 and placed in the cask decontamination area to be washed down. Id. The DOE cask lid would have been removed with the crane auxiliary hook, which has a 15-ton capacity, and set aside. Id. Before moving the DOE cask to the cask storage area, the cask storage area "would have been drained of water and bulkhead Gates 3A and 3B . . .

[41] Impact limiters are "removable external protective structures" "that reduce the mechanical forces imposed on the package under accident conditions." PX 1 at 23.

would have been removed to facilitate transfer of the DOE cask from the [cask decontamination area] to the [cask storage area]." Id. The DOE cask would have then been moved into the cask storage area using the crane. Id. Gates 3A and 3B would have been reinstalled, the interior of the DOE cask filled with borated water, and the cask storage area would have been refilled. Id. Gate 1, between the cask storage area and the spent fuel pool, would have been removed to allow spent nuclear fuel assemblies to be placed into the DOE cask. Then, the DOE cask lid would have been lifted by the crane auxiliary hook and lowered into place on the DOE cask.

Gate 1 would have been replaced, and the water in the cask storage area would have been drained again. Id. The DOE cask would have been prepared for shipping by draining the borated water, backfilling the cask interior with helium, and installing and tightening all remaining cask lid bolts for transport. Id. Using the crane, the DOE cask would have been moved into the cask decontamination area through Gates 3A and 3B and decontaminated. Id. at 26. Finally, the DOE cask would have been lifted through Gate 4 into the rail bay and loaded onto a DOE transport vehicle. Id.

The following diagram from Ms. Supko's expert report depicts this model.

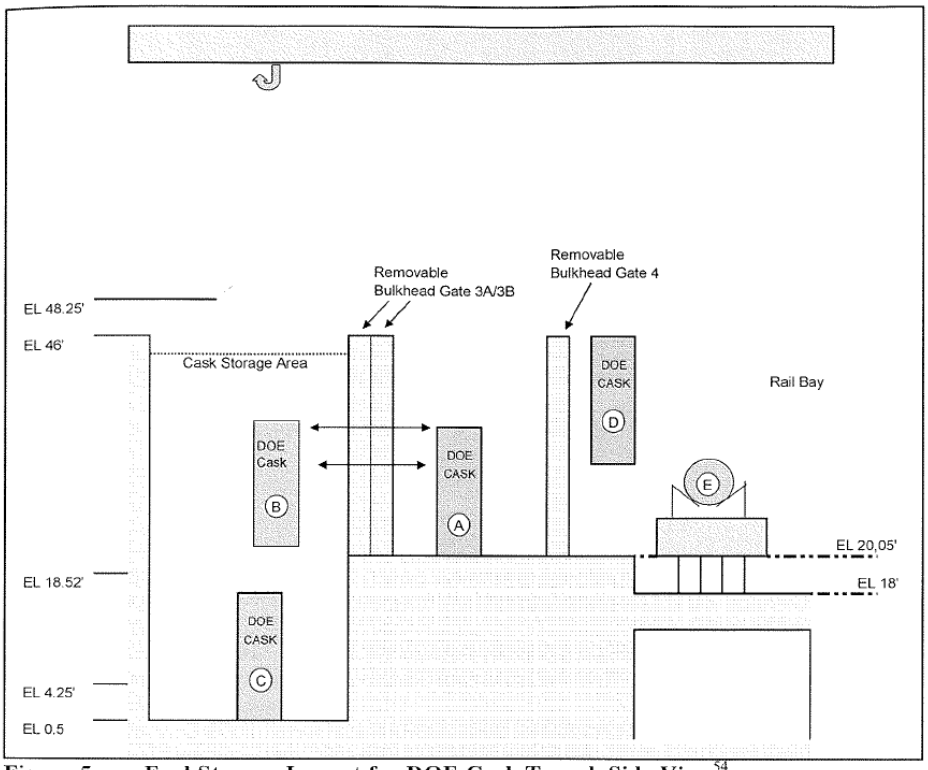

Figure 5 Fuel Storage Layout for DOE Cask Travel, Side View[54]

Id. at 27.

Ms. Supko's Model Would Require Plaintiffs to Repeatedly Load an Unreasonably Large Volume of Casks

Because Waterford 3's cask drop analysis had assumed a 23.5 ton cask, and because Ms. Supko considered a truck cask to be a "plausible choice," Ms. Supko limited her analysis to truck

casks that had weights of 23 to 27 tons. Id. at 18. These truck casks would have had a capacity of only one to four assemblies. However, assuming that, as Ms. Supko asserts, no NRC license amendment for heavy loads over the spent fuel would have been obtained, Plaintiffs would have been limited to using a one-assembly cask because these were the only type of cask with sufficiently light lids. Tr. 1646-47. While the Court finds that using a truck cask was possible at Waterford 3, the Court does not find it plausible that the plant managers would have chosen to be limited to using these small casks with very limited capacity instead of having the option to use larger rail casks with a 21- to 32-assembly capacity. See id. at 2931. The record indicates that rail casks with this increased capacity would have been a preferable option for Plaintiffs. See id. at 606, 667, 1631-32, 1637, 2630. As Mr. Maret testified, "the savings [of using the larger rail casks as opposed to the smaller truck casks] overwhelm the cost associated with the crane upgrade and, therefore, that's the best cost-benefit path to pursue." Id. at 2931.

As corporations, Plaintiffs sought to operate in an economically efficient manner. See id. at 105-06. In the non-breach world, Waterford 3's first allocation of spent nuclear fuel to be picked up by DOE would have been for 92 assemblies in 2006. Id. at 1525-26; PDX 6 at 7. The allocations in the years 2007-12, would have been 80, 85, 85, 85, 93, and 96 assemblies per year, respectively. Id.; Tr. 1525-26. Without an upgraded crane, Waterford 3 would have ended up loading 92 truck casks in 2006, whereas only three to five rail casks would have been needed to load the same quantity - - 92 assemblies. In the breach world, it took Waterford 3 from October 2011 to mid-November 2011, to load three 32-assembly Holtec casks and from March 2012 to the beginning of May 2012, to load six more 32-assembly Holtec casks. Tr. 296. Mr. Maret estimated that if a one-assembly cask were used, two casks per week would have to be shipped to keep up with the discharges into the spent fuel pool.[42] Id. at 2629. Therefore, if a large rail cask were used, Waterford 3 could remove spent nuclear fuel under its yearly allocations in less than a month, whereas if truck casks were used, it would take far longer to remove spent fuel, potentially over a year depending on the quantity.

The Court finds it implausible that the Waterford 3 managers would have made the inefficient choice of performing loading campaigns year round to remove one assembly at a time instead of making a single capital investment in an upgraded crane to be able to remove far more assemblies at once. The record establishes that upgrading the crane provided the plant the flexibility to accommodate any type of DOE cask used and that using a larger cask with the upgraded crane would greatly reduce the amount of loading activity. With an upgraded crane, the plant could have used any cask available from DOE, either truck or rail, outside of the parameters defined in the FSAR drop analysis, and would not have been limited to small, light casks.

[42] Mr. Maret calculated this two-per-week level by assuming that the plant would not be able to ship spent fuel for 12 weeks out of every 18-month fuel cycle due to the time needed to take old fuel out of, and put new fuel into, the reactor. Tr. 2628-29. Subtracting out this time left 56 weeks in the 18-month fuel cycle to ship fuel and, assuming 100 assemblies had to be shipped, this would require a shipping level of two per week. Id. at 2629.

Ms. Supko's Model Failed to Take Into Account the Inefficiency, Cost, Labor Intensity, and Risk Inherent in Draining and Refilling the Cask Storage Area Each Time a Cask is Loaded

The Court also finds Ms. Supko's model to be implausible because it required the plant to perform the inefficient, cost- and labor-intensive, time-consuming, and riskier work of draining and refilling the cask storage area each time a cask must be loaded. According to Ms. Supko's model, before a cask could be brought to the cask storage area, the cask storage area would have to be drained of water, and Gates 3A and 3B would have to be removed in order to move the cask from the cask decontamination area to the cask storage area. Once the cask had been moved to the cask storage area, Gates 3A and 3B would have to be reinstalled and the cask storage area would have to be refilled with water. Gate 1, which separates the cask storage area from the spent fuel pool, would have to be removed to allow spent fuel assemblies to be placed inside the cask, then replaced once the assemblies were inside the cask. Once Gate 1 was replaced, the cask storage area would have to be drained once again and Gates 3A and 3B removed once again in order to remove the cask from the cask storage area. Thus, for each cask to be picked up by DOE, the cask storage area would have to be drained and refilled twice, Gates 3A and 3B would have to be removed and replaced twice, and Gate 1 would have to be removed and replaced once.

In order to obviate the need for a single-failure-proof crane or additional drop analyses, Ms. Supko's proposed DOE cask had to be within the parameters of Waterford 3's existing FSAR cask drop analysis. Ms. Supko's model thus depends on a 30-ton DOE cask being lifted not more than 20 feet, as Ms. Supko believed that such a lift would fall within Waterford 3's existing FSAR cask drop analysis. PX 1 at 24. Further, a DOE cask would be required to withstand a 30-foot drop in order to be certified for transport by the NRC. This means that a 30-foot lift would be the maximum that could have been performed in the loading process in the non-breach world without a single-failure-proof crane. Id. According to Ms. Supko, a plant using a single-failure-proof crane does not need to perform a cask drop analysis since "the drop of a cask is not considered to be a credible accident." Id. at 11 n.16; see also Tr. 671-72, 826.

To avoid the need for a single-failure-proof crane or a new cask analysis, Ms. Supko created a model centered around removing Gates 3A and 3B and draining and refilling the cask storage area for each cask. The cask storage area floor is at elevation ("EL") 0.5', the top is at EL 46', and it is separated from the cask decontamination area by two gates. DDX 5 at 9. The cask decontamination area is shallower than the cask storage area, as its floor is at EL 20.05'. In the breach world, the Holtec cask is lifted from the two levels of the VECASP [variable elevation cask support pedestal] in the cask storage area (EL 4.25' and EL 18.25'), which remains full of water, and over the gates (EL 48.25') into the cask decontamination area. However, Ms. Supko's model does not use a VECASP or similar platform inside the cask storage area in the non-breach world, as this is another piece of equipment that is encompassed in Plaintiffs' damages claim. Therefore, in order to avoid a scenario in which the DOE cask would be lifted from the bottom to the top of the cask storage area, a lift beyond the DOE cask's 30-foot drop limit and not bounded by Waterford 3's cask drop analysis, Ms. Supko created a model in which the cask storage area is drained of water and the gates between the cask storage area and the cask decontamination area are removed. With this draining and gate removal, the DOE cask would only have to be lifted from EL 0.5' to EL 20.05'.

However, in creating her model, Ms. Supko failed to consider its costs and risks in the context of Waterford 3's operating philosophy - - all of which would have informed the non-breach world. Importantly, Waterford 3's managers strove to make conservative, risk-averse decisions, avoiding at all times increased radiation exposure. Specifically, Ms. Supko's model failed to take into account the following:

- Gate 3A had been welded shut soon after plant operations began in 1984-85 because leaking could not be reduced to below 30 gallons per hour. Tr. 611-12, 750. Additionally, Gate 1 and Gate 2 leaked. Id. at 703, 752. Given that multiple unsuccessful attempts had been made to stop the leaking, the Court does not find it plausible that, in the non-breach world, the risk-averse plant managers would choose to try to replace the gates and risk the uncontrolled release of radioactive water from the spent fuel pool and cask storage area if the gates failed. Further, it would be extremely dangerous if the water level in the pool decreased to the point that the spent fuel was exposed, due to an uncontrolled leak. Id. at 752-53, 2548-49. Even accepting that the gates could be repaired or replaced once, the known history of problems with the gates would likely have acted as a powerful deterrent in the non-breach world for using loading processes that relied on installing, moving, and reinstalling the gates to be leak proof for each loaded cask. Any leak would cause the release of radioactive material, a nightmare situation for the plant. The alternative of leaving the weld in place would have maintained the safe, stable, leak-proof status quo, consistent with the plant's operating philosophy.

- Any surface or item that had been in contact with the water of the spent fuel pool would be considered radiologically contaminated. Id. at 362-63. Thus, the gates would have to be decontaminated or wrapped up when removed. Id. at 373-74. Mr. Ferguson testified that Gates 3A and 3B are 20 to 30 feet wide and about 25 feet tall, making them extremely cumbersome to move. Id. at 695-96.

- The walls of the drained cask storage area, which are over 40 feet high, would also have had to be decontaminated before personnel could enter. Id. at 1589. Ms. Supko acknowledged that working in the drained cask storage area would require workers to wear protective clothing to protect against potential contamination. Id. at 1654.

- Ms. Supko did not take worker radiation dose into account, as she considered this a loading cost, which she was instructed by counsel not to consider, due to their interpretation of Carolina Power. Id. at 1622. However, the potential dose to workers would undoubtedly have been considered in the non-breach world because controlling radiation exposure has consistently been a key plant safety policy. For example, during the planning for the rerack, the plant managers considered how each bidder would deal with radiation and radioactive waste. See JX 30 at 0344-45. Ms. Supko acknowledged the ALARA policy of keeping the dose as low as reasonably achievable but did not consider how it would have impacted the choices made at the plant. Tr. 1655-56.

- The testimony of the fact witnesses did not completely support Ms. Supko's model with respect to draining. Mr. Laque, Senior Project Manager, was not sure if the cask storage area could be drained and had never seen this done since the plant began operations. Id. at 308. Mr. Ferguson, Senior Lead Engineer, did not know how long it would take to drain the cask storage area. Id. at 753. Mr. Ferguson also stated that he was not sure where they would put the water drained from the cask storage area, but suggested that it could be put back into the spent fuel pool and the spent fuel pool could be drained down or water could be pulled off to make room for the water from the cask storage area. Id. at 818.

- Ms. Supko's model does not indicate how the water would be drained from the cask storage area. The drain in the cask storage area was closed with a seal-welded plate. Id. at 2547-48. Ms. Supko also did not consider the time it would take to transfer 50,000 gallons of water. This transfer would add costs and time to the loading process. Id. at 2646-47.

- Ms. Supko did not analyze the costs for the gate movements in her model, or the costs of maintaining the gates and ensuring they were watertight each time they were installed. Id. at 1630. Relying upon the deposition testimony of Mr. Laque, Mr. Maret noted that it would take a crew of six about an hour and a half to move each gate section. Mr. Maret estimated that there are 10 gate movements in Ms. Supko's scenario, and Ms. Supko confirmed that Gates 1, 3A, and 3B must be removed and reinstalled for each cask. Id. at 1628-29. Gate 3A and 3B are made of two sections. Mr. Maret estimated that installing and removing the gates for each cask would consume 90,000 man-hours over the life of the plant, and would cost $5,564,700, and that ongoing maintenance and repair of the gates would cost another $5,280,000 over the life of the plant. DX 177 at 16-17. Notably, the combination of these two costs is more than the claimed cost of the crane. Mr. Maret concluded that, assuming operations through 2024, approximately 600 truck cask loading evolutions would have had to have been performed and the gates would have had been moved an equal number of times. DX 177 at 6.[43]

- Ms. Supko acknowledged that the drained cask storage area would not have any means for personnel to enter, and posited that scaffolding would be used to access the cask inside the cask storage area. However, Ms. Supko did not consider the cost of this work or the time it would take to be constructed, although she accepted that it would have to be built and removed 23 times, assuming a four-assembly capacity cask, during DOE's first pick up at Waterford 3 in 2006. Tr. 1631. The scaffolding thus would have needed to be built and removed 92 times if a one-assembly cask was used. Mr. Maret also estimated that tearing down and rebuilding the scaffolding for every cask would take 30-man hours, and cost $1,854,900 over the life of the plant. DX 177 at 15.

[43] The number of truck cask loading evolutions and gate moves would increase to 1,000 if the plant's license were extended to 2044. DX 177 at 7.

- All of the casks referenced by Ms. Supko would have used impact limiters when transported by road, but her model does not address how these impact limiters would have been handled within the plant. Tr. 1650-51. For example, the GA-4 casks, one of the plausible DOE casks analyzed by Ms. Supko, have lift trunnions that cannot be accessed while the impact limiters are in place. Id. at 2638-39.

The Court therefore does not find Ms. Supko's model of cask loading in the non-breach world to be plausible. Ms. Supko created a scenario that was physically possible at Waterford 3 without any modifications to the plant or its equipment, but she did not consider the costs, risks, and unreasonably difficult methodology associated with her model.[44] As Plaintiffs have failed to present a plausible model of the non-breach world with respect to a potential crane upgrade, - - a necessary predicate to recover damages - - the Court denies mitigation damages for upgrading the crane. See Yankee Atomic, 536 F.3d at 1273 (citing Bluebonnet Sav. Bank, 67 Fed. Cl. at 238).

Fuel Handling Building and Other Plant Modifications

Defendant further challenges Plaintiffs' entitlement to damages for other fuel handling building and plant modifications in the amount of $7,240,114. The Court will first address the lift yoke (and related stand) and the VECASP platform. Plaintiffs argue that these items would not have been necessary in the non-breach world because "Plaintiffs would have made the spent fuel pool gates operable so that the water could be drained from the cask storage area . . . ." Pls.' Post-Trial Reply Br. 20. However, as described above, the Court does not find it plausible that Plaintiffs would have loaded DOE casks using a procedure involving repeatedly draining and refilling the cask storage area and removing and reinstalling the gates for every cask loaded. See Tr. 1627. Rather, based upon Plaintiffs' operating philosophy, cost consciousness, aversion to risk, goal of efficiency and conduct evidenced throughout the record, the Court concludes that it is highly likely - - and far more likely than Plaintiffs' proposed construct - - that in the non-breach world, the crane would have been upgraded. However, the lift yoke and VECASP platform would have been necessary in the non-breach world. Mr. Laque testified that the water of the spent fuel pool contained boric acid and it was undesirable to submerge the crane load block and hook because "there's industry experience where you have metal being wasted away because of contact with boric acid." Id. at 284. The VECASP and lift yoke prevent the carbon steel crane hook and cables from being dipped into the water by raising the cask and extending the reach of the hook. Given this known problem with boric acid attacking steel crane components, in the non-breach world, Waterford 3 would still have procured a platform and lift yoke, and would have needed a stand for the lift yoke.

Plaintiffs, however, assert that "even if the Government is correct that Plaintiffs would have installed a VECASP to support loading of a DOE-supplied transportation cask, there is no evidence that Plaintiffs would have installed this specific VECASP in the non-breach world." Pls.' Post-Trial Reply Br. 20 (emphasis in original). Plaintiffs thus argue that the VECASP was unique to the Holtec system, implying that because that specific platform would not have been

[44] Mr. Maret opined that without a single-failure-proof crane, Waterford 3 would have had increased operating and maintenance costs associated with load movements, redundant rigging, and procedural controls. DX 177 at 14.

used in the non-breach world, they should be awarded damages for this mitigation activity. Id. (citing Tr. 693-94). This argument is not persuasive. As stated in Energy Northwest III, Plaintiffs must submit a hypothetical model establishing what its costs would have been absent the breach, so that the Court can compare this model with the parties' actual conduct and determine what costs were actually caused by the breach. Under Yankee Atomic, "a plaintiff must prove the extent to which his incurred costs differ from the costs he would have incurred in the non-breach world." Energy Northwest III, 641 F.3d at 1305.

Here, the Court finds it implausible that Plaintiffs would not have used any platform or lift yoke system in the non-breach world. However, Plaintiffs have provided no evidence as to what sort of platform and lift yoke would have been used. Without such proof, the Court cannot determine what Plaintiffs would have used with DOE performance and the difference between this platform or yoke type system and what they were forced to purchase due to DOE's breach. As the Court noted in the recent Grand Gulf II case, the relevant inquiry is not whether an item is specific to the Holtec system, but what costs Plaintiffs would have incurred in the non-breach world as compared to the costs for the Holtec system it chose due to the Government's breach. See Grand Gulf II, 120 Fed. Cl. at 671.

Plaintiffs make a similar argument regarding the cask decontamination work platform, a structural and seismic analysis, and 3D modeling of certain locations in the fuel handling building,[45] which were disallowed by Mr. Maret. While Defendant asserts that these activities would have been needed to load DOE casks, Plaintiffs argue that these modifications were done specifically because of its use of the Holtec system and will have to be repeated in the future. Def.'s Post-Trial Br. 34; Pls.' Post-Trial Reply Br. 20-21. At trial, Mr. Maret acknowledged that the work platform was designed for the specific dimensions of a Holtec cask, that the structural and seismic analysis and 3D modeling were also conducted specifically for the use of Holtec equipment, and that a new platform and new analyses may be necessary when DOE performs. Tr. 2807-13. However, it is Plaintiffs' burden to demonstrate how their costs in the non-breach world would have differed from their costs in the breach world. Ms. Supko asserted that instead of a work platform, Waterford 3 would have used scaffolding inside the cask storage area to close the cask, but did not consider the costs of this activity, or how a DOE cask would have been loaded if Waterford 3 would not have chosen to drain the cask storage area. See id. at 1631.

Plaintiffs apparently concede that the structural and seismic analysis and 3D modeling would have been necessary in the non-breach world, but do not address how much these analyses would have cost compared to the analyses for the Holtec system, thus preventing recovery.

The Government also challenges Plaintiffs' costs for removing the racks that were installed during the rerack and associated platform from the cask storage area. Def.'s Post-Trial Br. 34. Plaintiffs do not directly address this issue in their briefs. As the Court has found that the rerack was not caused by DOE's breach and would have occurred in the non-breach world, these racks would have existed in the cask storage area in the non-breach world. Therefore, their

[45] 3D modeling of the cask handling paths was done to ensure adequate clearances during cask loading operations using the Holtec equipment.

removal would have been necessary to load spent nuclear fuel in the cask storage area in the non-breach world.

Finally, the Government argues that Plaintiffs would have had to obtain an NRC license amendment to allow handling of heavy loads over a loaded transportation cask, as they did in the breach world. Def.'s Post-Trial Br. 34; Tr. 2678. Plaintiffs contend that this license amendment was needed specifically because the lid of the Holtec MPC constituted a heavy load, and the lid of a DOE cask might not have been a heavy load.[46] Pls.' Post-Trial Reply Br. 21 (citing Tr. 2813-15). In Ms. Supko's expert report, she posited that this NRC license amendment would not have been necessary in the non-breach world because the DOE truck casks that she analyzed had lids that weighed 1,510 pounds or less.[47] Tr. 1639.

However, Ms. Supko did not consider the weight of anything other than the lid. Id. at 1646-47. Ms. Supko conceded that adding the weight of the load block and hook to the weight of a 1,510 pound lid would put it over the 2,000 limit, but noted that two other cask designs would still be usable without a license amendment, as their lids were lighter. Id. However, both of these casks would have only held one fuel assembly. Id. at 1646; PX 1 at 22. Thus, in Ms. Supko's model of the non-breach world, without seeking a license amendment, Waterford 3 would have been limited to using one-assembly casks. The Court does not find it plausible that Waterford 3 managers would have opted to be limited to loading fuel into one-assembly truck casks, which would have required 92 casks to be loaded in 2006, instead of seeking an NRC license amendment for heavy loads. If an NRC amendment had been sought, Plaintiffs could have loaded four-assembly truck casks, reducing the number of casks needed from 92 to 23. Or, Plaintiffs could have loaded 21- or 32-assembly rails casks, lowering the number of casks needed to five or fewer.

General Project Management

Plaintiffs contend that the costs charged to Work Order N66105 "were related to the dry fuel storage project and would not have been incurred had Waterford not implemented dry fuel storage" due to DOE's failure to pick up spent nuclear fuel. Pls.' Post-Trial Br. 68. Mr. Ferguson and Mr. Laque credibly testified that the salaries of employees assigned to the dry fuel storage project were included in this Work Order, and that had Waterford not needed to additional storage space, the work assigned to N66105 would not have been done. Tr. 190-92,

[46] As stated in the Court's findings of fact, Waterford 3's administrative or procedural definition of a heavy load is 1,500 pounds. Tr. 815. This 1,500 pounds included the weight of the load, rigging, and hook. The crane's auxiliary hook, including load block, weighs 625 pounds. Id. at 1640. Waterford 3's FSAR defines a heavy load as 2,000 pounds. Id. at 815-16. During the implementation of its dry cask storage project, Waterford 3 obtained a license amendment to lift heavy loads over the spent fuel in a loaded cask. Id. at 1638-39. Prior to this amendment, loads in excess of the 2,000 pound limit could not be lifted over the spent fuel, as this limit was part of Waterford 3's operating license. Id. at 1369.

[47] Ms. Supko was apparently not aware when she wrote her report that Waterford 3 had a lower procedural limit (1,500 pounds) than its FSAR 2,000 pound limit. Ms. Supko testified that the procedural limit could be changed internally up to the FSAR limit without an NRC amendment. Id. at 1642-43.

443. Mr. Maret attempted to challenge some costs on this Work Order, stating that Work Order N66105 "was utilized primarily to capture project management and oversight costs," despite acknowledging that this work order "includes activities related to the unique or potentially unique" modifications of the Fuel Handling Building, as well as other items not unique to Waterford, and that "the balance of the activities charged to the Work Order cannot be linked to any of the dry fuel storage sub-project areas . . . ." Pls.' Post-Trial Br. 67-68 (internal citations and quotation marks omitted). Plaintiffs point out that Mr. Maret's analysis was "cursory and counterintuitive," as he spent a total of four hours analyzing the line items associated with this Work Order, and that when Mr. Maret was unable to categorize a line item, he "would leave the category blank and the item was subsequently disallowed by Mr. Peterson." Id. at 68. Plaintiffs further note that "Mr. Maret's report says nothing about the costs charged to this Work Order being nonetheless necessary in a non-breach world," and in fact, that Mr. Maret testified that he was not denying that the costs associated with N66105 "were not legitimately part of Plaintiffs' claim." Id. at 68.

Defendant challenges $1,897,942 in costs associated with Work Order N66105. Mr. Peterson's staff prepared a spreadsheet, which was reviewed by Mr. Maret. Mr. Maret left blank any line items that he did not believe he had sufficient information to make a judgment about, even though such a blank would have the effect of Mr. Peterson disallowing the item. Tr. 2891.[48]

The Court finds that Plaintiffs sufficiently demonstrated that the costs charged to Work Order N66105 were related to the dry fuel storage project, and that Defendant's experts' disallowance of costs simply because Mr. Maret could not quickly determine their purpose, was unpersuasive.

Payroll Loaders

The Government challenges $266,276 in payroll loader costs associated with Resource Codes 19 and 60. As the Court has determined that the rerack, crane upgrade, and other fuel handling building and plant modifications were not caused by the Government's breach, the Court does not award Plaintiffs $94,554 for the Resource Code 19 and 60 payroll loaders connected to these projects. As to the remaining amount, the Government argues that Resource Code 19 includes costs incurred prior to the claim period, including the costs of retired personnel, changes in interest rates, and "amortizations resulting from changes in accounting methods or regulations." Def.'s Post-Trial Br. 46-47. The Government asserts that the charges to this resource code "fluctuate based upon factors unrelated to DOE's performance, such as changes in the economy, or in the case of the amortization, driven by changes in accounting methods." Id. at 47. The Government concludes that "[t]he underlying costs allocated through Resource Code 19 are not attributable to any delay in DOE performance, or even work done to mitigate such delay." Id. at 49. As for Resource Code 60, the Government argues that because Ms. Barras was not aware if anyone who worked on the dry fuel storage project at Waterford 3

[48] Mr. Maret apparently reviewed 17 pages of line items in four hours, occasionally looking at underlying invoices or other documentation when he was unable to categorize a particular line item. Id. at 2895.

received stock options, these costs were not incurred due to the Government's breach. Id. at 50; Tr. 556.

In System Fuels, Inc. v. United States ("System Fuels IV"), the Federal Circuit held that the plaintiffs "may recover overhead costs incurred for mitigation related work" and found that the plaintiffs could recover their capital suspense loaders.[49] 666 F.3d 1306, 1312 (Fed. Cir. 2012). The Federal Circuit noted that the plaintiffs used an internal accounting system that was FERC- and GAAP-compliant and that the trial Court had "clearly erred" in finding that the plaintiffs had not proven these damages with reasonable particularity. Id. Indeed, the amount of damages did not have to be "'ascertainable with absolute exactness or mathematical precision.'" Id. at 1311 (quoting Indiana Michigan Power Co., 422 F.3d at 1373). In Grand Gulf II, the COFC followed System Fuels IV and granted the plaintiffs their payroll loaders associated with Resource Codes 19 and 60. Grand Gulf II, 120 Fed. Cl. at 663. The Grand Gulf II Court noted that the plaintiffs had established their entitlement to these costs because they complied with GAAP.[50] Id.; but see Sys. Fuels, Inc. v. United States, 120 Fed. Cl. 737, 758-59 (2015) ("ANO II") (awarding damages for Resource Code 19, but not Resource Code 60).

Under System Fuels IV, utilities are entitled to receive overhead costs associated with mitigation activities. 666 F.3d at 1312. The Court credits Ms. Barras' testimony that she had no reason to believe that Entergy's accounting for payroll, material, and capital suspense loaders was not FERC- and GAAP-compliant. Tr. 574.[51] The Court therefore accepts that these costs were properly accounted for and allocated by Entergy to the mitigation activities that were performed by Plaintiffs due to the Government's partial breach. These payroll loaders should thus be considered part of the costs incurred by Plaintiffs as a result of the Government's failure to perform under the Standard Contract. The Court awards Plaintiffs the remaining $171,722 in payroll loaders for Resource Codes 19 and 60.

Precedent Precludes Awarding Plaintiffs Part 171 Generic NRC Fees

Plaintiffs claim damages of $1,942,000 for payment of the NRC's SFS/RD fee. Plaintiffs assert that DOE's breach was a "substantial causal factor" of the NRC's decision to change the fee rule in 1999. As the Federal Circuit recognized:

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[49] In this case, the parties have stipulated that if a claimed damages item is recoverable, then the associated materials loader and capital suspense loader is recoverable, except for costs incurred from 1996 to June 30, 1998.

[50] The Grand Gulf II Court expressed its opinion that the plaintiffs should not be awarded damages for stock option bonuses for highly-compensated employees, but believed that "precedent compels the award of payroll loaders under Resource Code 60." Sys. Fuels, Inc. v. United States, 120 Fed. Cl. at 663, n.18 (citing Sys. Fuels, Inc. v. United States, 666 F.3d 1306, 1312 (Fed. Cir. 2012)).

[51] Based upon the demeanor of the witness, the Court found Ms. Barras' testimony to be credible.

> Before 1999, the NRC charged an annual generic fee to all licensees operating nuclear reactors to cover the NRC's general expenses related to wet storage and nuclear plant decommissioning. Before 1999, the NRC also charged a separate annual generic fee to all licensees with dry storage facilities to cover the NRC's generic expenses related to dry storage. The 1999 rule change eliminated the separate generic fees for (1) dry storage, and (2) wet storage and decommissioning, and created a new annual Spent Fuel Storage/Reactor Decommissioning ("SFS/RD") fee, which covered the NRC's generic costs related to both dry storage and wet storage as well as decommissioning. Specifically, the annual SFS/RD fee covered "the costs of the NRC's generic and other research activities directly related to reactor decommissioning and spent fuel storage (both [wet and dry] storage options), and other safety, environmental, and safeguards activities related to reactor decommissioning and spent fuel storage." . . . The 1999 rule change combined the previously separate categories for wet storage and dry storage, and covered the NRC's generic wet-storage costs with a single SFS/RD fee that applied to all licensees with either wet storage or dry storage on site.

Consol. Edison Co. of N.Y. v. Entergy Nuclear Indian Point 2, LLC, 676 F.3d 1331,1338 (Fed. Cir. 2012) (internal citation omitted).

Plaintiffs claim their increase in generic NRC fees was caused by DOE's breach. Plaintiffs posit that if DOE had performed under the Standard Contract, very few utilities would have chosen dry storage over wet storage, and the NRC would have had no justification or need to charge an industry-wide generic dry storage fee, given the fairness requirement of OBRA-90. Pls.' Post-Trial Br. 66. OBRA-90 states:

> The Commission shall establish, by rule, a schedule of charges fairly and equitably allocating the aggregate amount of charges described in paragraph (2) among licensees. To the maximum extent practicable, the charges shall have a reasonable relationship to the cost of providing regulatory services and may be based on the allocation of the Commission's resources among licensees or classes of licensees.

42 U.S.C. § 2214(c)(3) (2012). Plaintiffs further contend that DOE's breach caused many utilities to implement dry storage, necessitating the revised generic fee in 1999. Pls.' Post-Trial Br. 66. Plaintiffs support their causation argument with the expert testimony of Jesse Funches, the former Chief Financial Officer of the Nuclear Regulatory Commission.

Mr. Funches stated that "the crux of his opinion" was that in its 1999 rule, the NRC changed its fee allocation method as a result of DOE's breach. Tr. 1351-52. In Consolidated Edison, the Federal Circuit held that the plaintiffs had not provided sufficient evidence to prove this theory of causation, based upon the NRC's public statements in its proposed and final rulemaking, the comments of NRC Commissioner Merrifield in an internal NRC memorandum accompanying his vote, and the comments of NRC Commissioner McGaffigan. Consolidated Edison, 676 F.3d at 1340. The Court reasoned that though the NRC briefly acknowledged the

DOE's breach in the final rulemaking,[52] "the only public statements in the record that were made on behalf of the NRC express a concern over the fairness of the generic fee assessment, and do not establish any direct link between DOE's breach and the 1999 rule change." Id. at 1339.

The Consolidated Edison Court found that NRC Commissioner Merrifield's memorandum accompanying his vote on the fee change was also insufficient to prove causation. In relevant part, Commissioner Merrifield commented:

> [I]t is unfortunate that the federal government has not provided for permanent disposal of high-level waste. Because of the delay in the DOE high-level waste repository program, I believe the Commission should seek legislation for FY2000 to amend the Nuclear Waste Policy Act so that generic costs associated with the NRC's spent fuel storage activities can be derived from the Nuclear Waste Fund.

Id. (internal citation omitted). The Court reasoned that Commissioner Merrifield's comments simply mirrored the NRC's objective to facilitate equitable fee treatment that would not penalize licensees for the fuel storage option utilized, and concluded that his comment on amending the NWPA did not directly link the DOE's breach to the fee change. Id.

Consistent with Consolidated Edison, in order to recover NRC fees in the instant action, Plaintiffs must proffer evidence of a direct link between DOE's breach and the 1999 rule change. Mr. Funches testified as an expert witness in the instant case, and his testimony was based on similar evidence to that previously analyzed by the Federal Circuit and found insufficient in Consolidated Edison:

- Excerpts of the March 1995 Congressional testimony of former NRC Chairman Ivan Selin concerning the assessment of annual fees. PX 998;

- A February 2, 1998 memorandum from NRC Secretary John Hoyle to NRC Chairman Shirley Jackson and NRC Commissioner Edward McGaffigan, Jr. ("February 1998 Memorandum"), with Mr. Funches copied on the memorandum. JX 9;

- Mr. Funches' February 27, 1998 "Policy Issue" memorandum to the NRC Commissioners ("Sec'y 98-034"), which requests that the Commissioners consider whether to use rebaselining or a percent change as the methodology for calculating fiscal year 1998 annual fees. JX 10;

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[52] In the final rulemaking, the NRC referenced the DOE breach as follows:

> The NRC recognizes that sites will be required to continue to store spent fuel onsite until another solution becomes available. The fact that DOE has not taken possession of the spent fuel does not relieve NRC of the OBRA-90 requirement to recover approximately 100 percent of its budget authority through fees, including those costs associated with generic spent fuel storage activities.

Revision of Fee Schedules; 100% Fee Recovery, FY 1999, 64 Fed. Reg. at 31,455.

- A March 9, 1998 Staff Requirements Memorandum ("SRM")[53] from NRC Secretary Hoyle to Mr. Funches and Executive Director for Operations, L. Joseph Callan. DX 218;

- Mr. Funches' November 5, 1998 "Policy Issue" memorandum to the NRC Commissioners ("Sec'y 98-260"), which included the October 1998 Spent Fuel Storage and Decommissioning Study. DX 224;[54]

- A February 2, 1999 SRM – drafted in response to Sec'y 98-260 – from NRC Secretary Annette Vietti-Cook to Mr. Funches and General Counsel Karen Cyr, with the Commissioners copied. JX 14.

See generally Tr. at 1140-1452.

Like the evidence before the Federal Circuit in Consolidated Edison, the internal NRC documents in evidence in the instant action – specifically, Sec'y 98-304, the February 1998 memorandum, and the March 1998 SRM – emphasized the NRC's concerns about unequal fee treatment creating a disincentive to use dry fuel storage and the need to address this concern by changing the fee structure. The documents in evidence here did not expressly attribute the need to change the fee structure to DOE's breach of the Standard Contract. See, e.g., JX 10 at 4 (Sec'y 98-304) ("[R]eactor licensees are not assessed an annual fee for a Part 50 possession only license, but are assessed an annual fee for a Part 72 [ISFSI]. We understand that the Commission is looking at this issue from the perspective that it could result in a possible disincentive for licensees to pursue spent fuel storage under Part 72 versus spent fuel storage under Part 50."); JX 9 at 2 (February 1998 Memorandum) ("As a minimum, the CFO should be directed to ensure that the fee policy gives equal treatment to dry storage and SFP storage of spent fuel, thereby removing the existing disincentive for dry storage."); DX 218 (March 1998 SRM) ("Since the Commission has formally found that both wet and dry storage are safe and acceptable, the Commission believes that actions such as annual licensing fees should not arbitrarily favor one method over another or create incentives to choose one approach over another. For this reason, the staff should revise the fee rule (Part 171) in a way that gives equivalent fee treatment to both storage options.").

Other NRC documents, Sec'y 98-260 and the October 1998 Spent Fuel Storage and Decommissioning Study also contained similar reasoning about eliminating a potential disincentive to use dry storage. See DX 224 at 9 (Sec'y 98-260) ("The current policy has raised two concerns: (1) the fee structure could create a disincentive for licensees to pursue dry storage;

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[53] A SRM is a Commission decision that requests the NRC staff to perform a specified task. Tr. 1292.

[54] Mr. Funches' Sec'y 98-260 memorandum and his October 1998 Spent Fuel Storage and Decommissioning Fee Study were included in the appendix to the papers filed in Consolidated Edison, although the Federal Circuit did not analyze their contents. See Alabama Power, 119 Fed. Cl. at 639, n.5 (noting while the Federal Circuit may have technically considered this document, the Court chose to review it because the Federal Circuit did not specifically discuss it in the Consolidated Edison opinion).

and (2) the fairness of assessing multiple annual fees if a licensee holds multiple ISFSI licenses for different designs."); DX 224 Attach. 2 at 1 (Spent Fuel Storage and Decommissioning Study) ("The purpose of this study is to address issues raised by the Commission on current license fee policies. Specifically, a . . . Staff Requirements Memorandum . . . directed staff to revise 10 CFR Part 171 to provide equivalent annual fee treatment to both wet storage . . . and dry storage (independent spent fuel storage installations or ISFSIs) of spent fuel.").

In the Spent Fuel Storage and Decommissioning Fee Study, Mr. Funches' team ultimately recommended the adoption of a SFS/RD fee to eliminate any disincentive to use dry fuel storage, and secondarily recommended that, in the long term, the NRC seek an amendment to the Nuclear Waste Policy Act allowing the recovery of increased regulatory costs from the Nuclear Waste Fund. DX 224 Attach. 2 at i-ii. The Commission responded to these recommendations in the February 2, 1999 SRM, informing Mr. Funches and General Counsel Karen Cyr that the rule imposing the SFS/RD fee could be issued for public comment, and requesting that the study team brief the Commission on the advisability of amending the NWPA.

Therefore, similar to the NRC's public statements in the Federal Register, the NRC internal documents supporting Mr. Funches' testimony in the instant action connect the fee change to the NRC's commitment to eliminate any disincentive to store dry fuel. These internal NRC documents echo the NRC's public statements in the Federal Register, which the Federal Circuit held insufficient to prove causation in Consolidated Edison.

While a member of Congress questioning Chairman Selin linked the need to build ISFSIs to the DOE breach, Chairman Selin did not affirm that sentiment in his March 3, 1995 testimony before the House Subcommittee on Energy and Water Development. When asked by subcommittee Chairman John Myers:

> Since utilities are being forced to build these ISFSI facilities because DOE has been unable to take possession of spent fuel, why doesn't the NRC include these costs in the budget request to be derived from the Nuclear Waste Fund?

Chairman Selin responded:

> We do not include the costs for independent spent fuel storage installations at commercial reactor sites in the part of the budget appropriated from the Nuclear Waste Fund (NWF) because we understand such funding is not authorized at present under the Nuclear Waste Policy Act, as amended. This Act gave DOE responsibility to administer the fund and specified the purposes of expenditures from it. In particular, section 302 of the NWPA, which establishes the [Nuclear Waste Fund], indicates that expenditures from the [Nuclear Waste Fund] are for purposes of radioactive waste disposal activities under certain provisions of the NWPA . . . . An [ISFSI] licensed to and operated by utilities would not appear to fall within the purview of this definition.

PX 998 at 1213-14.

The Congressional testimony of former Chairman Selin mirrored the sentiments of NRC Commissioner Merrifield in his memorandum accompanying his vote sheet, which the Federal Circuit also held insufficient to prove causation. Furthermore, unlike Commissioner Merrifield,

former Chairman Selin was not a member of the Commission in 1999 and did not vote on the creation of the SFS/RD fee. Tr. 1337.

The testimony of Mr. Funches did not cure this evidentiary deficit. Mr. Funches was qualified as an expert in NRC annual fee assessment, including the SFS/RD fee adopted in 1999. Id. at 1178-79. The Court qualified Mr. Funches as an expert due to his extensive experience working for the NRC, including as CFO, and his involvement in the formulation of the SFS/RD fee. Mr. Funches opined that "DOE's delay in picking up the spent fuel from power reactors as anticipated caused the NRC to modify how it allocated its generic costs of dry spent fuel storage and allocate those costs to all power reactors." Id. at 1243.

While Mr. Funches' testimony regarding the allocation of the fee is an appropriate expert opinion under FRE 702, based upon his specialized financial knowledge, his testimony about why the Commission imposed the fee in the first place was in essence factual, and based more upon his personal knowledge of DOE's breach and his understanding that the fee change was predicated on that breach. Id. at 1224. However, the record does not support a factual finding that Mr. Funches had, or was privy to, the knowledge of why the Commission voted to impose this fee:

- Mr. Funches was not one of the five NRC Commissioners who voted for the SFS/RD fee. Tr. 1168.

- Mr. Funches was never delegated authority to be a spokesperson for the Commissioner and did not have authority to speak on behalf of the NRC when he testified at trial. Id. at 1169-70, 1337-38.

- Mr. Funches could not recall any specific meetings or conversations he had with the Commissioners in which any Commissioner stated that DOE's delay caused utilities to implement dry storage or that this delay was the reason the Commissioners voted for the SFS/RD fee. Id. at 1173.

- Mr. Funches was never directed to look at revising the Part 171 fee structure because of DOE's delay in accepting spent nuclear fuel. Id. at 1377.

- Mr. Funches acknowledged that no contemporaneous NRC document links the potential disincentive to implement dry fuel storage under the pre-SFS/RD fee structure to DOE's delay, and no document or public statement of the NRC explicitly links its 1999 fee rule change to DOE's delay. Id. at 1428-29.

- Leading up to the 1999 fee change, there was discourse within the NRC about the DOE's breach and the resulting increase in dry fuel storage and the associated costs. Id. at 1254 ("During that time frame, my understanding is that situation as it relates to the budgeted costs was the DOE was not picking up the fuel and that most power reactors would need to have dry spent fuel storage."); see also PX 998; JX 10; DX 224.

- The nuclear industry's increased use of ISFSIs – resulting from the DOE's breach – and the associated costs were of concern to the NRC while it considered changing its existing fee structure. PX 998; DX 224 Attach. 2 at 4.

- The Commission considered the option of diverting funds from the Nuclear Waste Fund to recover costs associated with increased dry fuel storage. See PX 998; JX 12; Tr. 1278.

- The NRC chose to modify 10 CFR Part 171 fees, or annual fees, instead of licensee-specific fees because the NRC recognized that eventually most licensees in the industry would be using dry fuel storage due to the absence of a federal facility as a result of the DOE's breach. Tr. 1273-75.

The Consolidated Edison Court emphasized the absence of an NRC-issued public statement in the Federal Register identifying the DOE's breach as the cause for the fee change. The Court stated:

> [Plaintiff] has failed to show that the 1999 rule change was the result of DOE's breach. The NRC's public statements do not suggest that the 1999 changes were the result of DOE's breach . . . . [T]he only public statements in the record that were made on behalf of the NRC . . . do not establish any direct link between DOE's breach and the 1999 rule change.

See Consolidated Edison, 676 F.3d at 1338. Mr. Funches' testimony, although informed by his experience as the NRC's CFO and his awareness of the impact DOE's well-known delay had on the regulatory climate, does not meet the stringent legal requirement for causation established in Consolidated Edison - - that the NRC itself attribute DOE's breach as the reason for implementing the 1999 SFS/RD fee.[55] Nor did Mr. Funches recall any NRC member making such an explicit statement. However, Mr. Funches provided detailed and extensive testimony regarding the portion of the SFS/RD fee attributable to dry spent fuel storage, which the Court would credit if there had been a causation finding.

Mr. Metcalfe's attempt to use "economic reasoning" to explain why the NRC changed its fee structure cannot form a basis to award Plaintiffs NRC fees under Consolidated Edison. See Tr. 1835-36. Mr. Metcalfe based his testimony on the concept that it would not have made "economic sense" for the NRC to have considered recouping its additional regulatory costs from the Nuclear Waste Fund if these costs were not related to DOE's delay in accepting spent nuclear fuel. Id. at 1842-46; Pls.' Post-Trial Br. 67. However, in Consolidated Edison, the Federal Circuit expressly rejected the trial court's finding that Commissioner Merrifield's comment that

[55] Consolidated Edison's requirement that the public record on the rulemaking contain an express statement directly linking DOE's breach and the fee change imposes a heavy causation burden on the non-breaching party. Factors which inform an agency's exercise of discretion in rulemaking are deliberative and not readily susceptible to probing by the litigation process. The published federal rulemaking process – notice and comment – while transparent, is not an ideal vehicle for assessing whether a partial breach of contract by a fellow government agency was the driving force behind a fee change.

the NRC should seek legislation to amend the NWPA to allow the NRC to recoup its generic spent fuel storage costs from the Nuclear Waste Fund, "'confim[ed] the existence of a direct link between DOE's breach and the NRC's 1999 fee change.'" Consolidated Edison Co., 676 F.3d at 1339 (quoting Consolidated Edison, 92 Fed. Cl. at 515). In light of Consolidated Edison, the similar suggestion contained in the other NRC documents cited by Mr. Metcalfe, would be "insufficient as a matter of law to demonstrate that the new NRC rules were the result of the government breach." Id.

Allegedly Unsupported Transactions

Defendant challenges $1,488,727 of Plaintiffs' claim as allegedly unsupported. The parties have stipulated that $1,253,893 of that amount is associated with the rerack project. As the Court has determined that Plaintiffs are not entitled to damages for the rerack project, the Court also reduces Plaintiffs' claim by $1,253,893. Similarly, the parties stipulated that $7,600 of the total amount of allegedly unsupported costs is associated with the crane upgrade, which is also disallowed.

The remaining $227,234 consists of two invoices that were charged to Work Order N66105 for dry fuel storage – BCP Technical Services, Inc. invoice # 7819 and Holtec invoice #81143. [56] The BCP Technical Services invoice indicated that it was for $5,616, comprising [***] hours of an employee with the job title "Scheduler." PX 1074 2-c at 8720. Plaintiffs also provided this employee's timesheets and the associated contract between Entergy Operations, Inc. and BCP Technical Services, Inc. for support services, including scheduling. Id. at 3044. Mr. Metcalfe or a staff member added a handwritten note to the contract stating that Mr. Laque had represented that BCP Technical Services, Inc. "provided engineering services in support of dry fuel." Id. The Holtec invoice #81143 indicated that it was for a "milestone payment due upon submission of final fuel handling building modification report." Id. at 8726. Plaintiffs also provided the associated contract, a negotiated check, and a printout from Entergy's accounting system indicating that this invoice had been paid.

These invoices were disallowed by Mr. Peterson because of "unanswered discovery requests" relating to these invoices. As Mr. Peterson stated, for these invoices, all the necessary documents were present from "an accounting perspective," but Mr. Maret's firm, ABZ, had requested "information on a wide variety of different work orders and individual invoices" to determine technically if these charges were connected to the claimed damages. Tr. 2988-90, 2992. Mr. Peterson noted that on September 17, 2012, Defendant requested from Plaintiffs' counsel information about specific invoices, including the two at issue here. Id. at 2990-91; DX 234 at 1-10; DDX 6 at 18.

When asked what information was still outstanding regarding this particular group of transactions, Mr. Peterson did not provide any specifics, but stated:

> Again, for the most part, it would be in discussions with ABZ, they could understand in some cases what, on the face of the documents, they were saying the work was but couldn't understand the connection to the particular overall

[56] The parties stipulated that $88,388 in allegedly unsupported costs are associated with general project management costs.

> work order to which it was charged or they had a document that did not provide sufficient description of the work and, therefore, they had no idea what was going on at all and then, similarly, could not understand whether or not it was connected to the work that was being claimed.

Tr. 2992. Mr. Maret did not testify regarding these invoices and did not explain in his report what technical information he believed had not been supplied. Mr. Peterson subtracted these invoices from Plaintiffs' claim after being informed by ABZ employees that they should not be included. Id. at 3111-12, 3127-28.

For BCP Technical Services, Inc. invoice #7819, Mr. Peterson could not remember why Mr. Maret and ABZ had questioned it other than "there was reference to that there was something wrong with the activity descriptions that did not seem to comport with anything that rationally would be included within a claim for the scope of the work order." Id. at 3110. For the second invoice, Holtec invoice #8114, Mr. Peterson only stated that he was informed that ABZ did not have sufficient information to be able to determine whether the costs in this group of invoices were appropriate. Id. at 3112.

The Court credits the testimony of Mr. Metcalfe that these invoices were paid and properly included in Plaintiffs' claim. Id. at 1960-64. Mr. Metcalfe's opinion was based on discussions with Waterford 3 personnel, who would be in the best position to know why certain work took place onsite and how it related to the dry fuel storage project. It was entirely unclear, other than general references to unsatisfactory discovery responses, on what technical basis Mr. Maret believed the charged amounts should not be included in Plaintiffs' claim. Therefore, the Court awards Plaintiffs $227,234 for these invoices.

The Court Awards Plaintiffs the Remainder of Their Claimed Damages

With the exceptions of the modifications discussed above, the Government concedes that Plaintiffs' damages for its dry fuel storage project, including the ISFSI, haul path improvements, security, and Holtec cask purchases, were caused by the Government's breach of the Standard Contract.

In the non-breach world, Plaintiffs would not have had to store their spent fuel on-site. It is uncontroverted that had DOE performed, Plaintiffs would not have required the extra storage space provided by placing spent fuel on an ISFSI in Holtec storage canisters. The Court credits the testimony of Messrs. Rives, Ferguson, Laque, and Metcalfe that Waterford 3 would not have implemented these dry storage activities had DOE performed. The Court holds that Plaintiffs' remaining claimed and uncontested damages were reasonably foreseeable to the Government at the time of contracting, were caused by the breach, and were shown with reasonable certainty. See Indiana Michigan Power Co., 422 F.3d at 1373 (citing Energy Capital Corp., 302 F.3d at 1320). Therefore, Plaintiffs are entitled to damages for these mitigation efforts in the amount of $47,106,441.

Conclusion

The Court awards Plaintiffs damages in the amount of$49,403,339. The Clerk is directed to enter final judgment for Plaintiffs in this amount.

Plaintiffs retain the right to bring subsequent actions on claims for damages incurred after June 30, 2012. See ANO II, 120 Fed. Cl. at 767 (citing Indiana Michigan Power Co., 422 F.3d at 1377).

s/Mary Ellen Coster Williams
MARY ELLEN COSTER WILLIAMS
Judge